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Configuration Guide for HP-UX® Host Attachment

Hitachi Virtual Storage Platform
Hitachi Universal Storage Platform V/VM

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Hitachi Data Systems

MK-96RD638-06

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Preface

This document describes and provides instructions for installing and configuring the devices on the Hitachi RAID storage systems for operations in an HP-UX environment. The Hitachi RAID storage system models include the Hitachi Virtual Storage Platform (VSP) and the Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM (USP V/VM).

Please read this document carefully to understand how to use this product, and maintain a copy for reference purposes.

This preface includes the following information:

- ☐ Intended Audience
- ☐ Product Version
- ☐ Document Revision Level
- ☐ Source Documents for this Revision
- ☐ Changes in this Revision
- ☐ Referenced Documents
- ☐ Document Organization
- ☐ Document Conventions
- ☐ Convention for Storage Capacity Values
- ☐ Getting Help
- ☐ Comments

Intended Audience

This document is intended for system administrators, Hitachi Data Systems representatives, and authorized service providers who are involved in installing, configuring, and operating the Hitachi RAID storage systems.

Readers of this document should meet the following requirements:

- You should have a background in data processing and understand RAID storage systems and their basic functions.
- You should be familiar with the Hitachi RAID storage system(s), and you should have read the *User and Reference Guide* for the storage system.
- You should be familiar with the Storage Navigator software for the Hitachi RAID storage system(s), and you should have read the *Storage Navigator User's Guide*.
- You should be familiar with the HP-UX operating system and the hardware hosting the HP-UX system.
- You should be familiar with the hardware used to attach the Hitachi RAID storage system to the HP-UX host, including fibre-channel cabling, host bus adapters (HBAs), switches, and hubs.

Product Version

This document revision applies to the following microcode levels:

- Hitachi Virtual Storage Platform microcode 70-01-0x or later.
- Hitachi Universal Storage Platform V/VM microcode 60-04-0*x* or later.

Document Revision Level

Revision	Date	Description
MK-96RD638-P	February 2007	Preliminary Release
MK-96RD638-00	May 2007	Initial Release, supersedes and replaces MK-96RD638-P
MK-96RD638-01	September 2007	Revision 1, supersedes and replaces MK-96RD638-00
MK-96RD638-02	January 2008	Revision 2, supersedes and replaces MK-96RD638-01
MK-96RD638-03	November 2008	Revision 3, supersedes and replaces MK-96RD638-02
MK-96RD638-04	January 2010	Revision 4, supersedes and replaces MK-96RD638-03
MK-96RD638-05	October 2010	Revision 5, supersedes and replaces MK-96RD638-04
MK-96RD638-06	April 2011	Revision 6, supersedes and replaces MK-96RD638-05

Source Documents for this Revision

- Not applicable.

Changes in this Revision

- Added information about the system option modes (SOMs) and instructions for setting the SOMs (new section Setting the System Option Modes).

Referenced Documents

Hitachi Virtual Storage Platform documentation:

- *Provisioning Guide for Open Systems*, MK-90RD7022
- *Storage Navigator User Guide*, MK-90RD7027
- *Storage Navigator Messages*, MK-90RD7028
- *User and Reference Guide*, MK-90RD7042

Hitachi Universal Storage Platform V/VM:

- *Storage Navigator Messages*, MK-96RD613
- *LUN Manager User's Guide*, MK-96RD615
- *LUN Expansion (LUSE) User's Guide*, MK-96RD616
- *Storage Navigator User's Guide*, MK-96RD621
- *Virtual LVI/LUN and Volume Shredder User's Guide*, MK-96RD630
- *Cross-OS File Exchange User's Guide*, MK-96RD647

HP-UX documentation

Document Organization

The following table provides an overview of the contents and organization of this document. Click the chapter title in the left column to go to that chapter. The first page of each chapter provides links to the sections in that chapter.

Chapter	Description
Introduction	Provides a brief overview of the Hitachi RAID storage systems, supported device types, and an installation roadmap.
Installing the Storage System	Provides instructions for installing and connecting the Hitachi RAID storage system to an HP-UX host.
Configuring the New Disk Devices	Provides instructions for configuring the new devices on the Hitachi RAID storage system for use.
Failover and SNMP Operation	Describes how to configure the Hitachi RAID storage system for failover and SNMP.
Troubleshooting	Provides information for identifying and resolving problems.
SCSI ID Maps for Fibre-Channel Adapters	Describes SCSI TID maps for fibre-channel adapters.
Reference Information for SAM	Describes use of System Administration Manager (SAM) to perform storage system-related tasks.
Online Device Installation	Provides instructions for online installation of new devices.
Note on Using Veritas Cluster Server	Provides information about adding reserve keys for LUs to increase disk capacity.
Acronyms and Abbreviations	Defines the acronyms and abbreviations used in this document.

Document Conventions

The terms “Virtual Storage Platform” and “VSP” refer to all models of the Hitachi Virtual Storage Platform storage system, unless otherwise noted.

The terms “Universal Storage Platform V/VM” and “USP V/VM” refer to all models of the Hitachi Universal Storage Platform V/VM storage systems, unless otherwise noted.

This document uses the following typographic conventions:

Convention	Description
Bold	Indicates text on a window, other than the window title, including menus, menu options, buttons, fields, and labels. Example: Click **OK**.
Italic	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: copy *source-file target-file* ***Note:*** Angled brackets (< >) are also used to indicate variables.
screen/code	Indicates text that is displayed on screen or entered by the user. Example: `# pairdisplay -g oradb`
< > angled brackets	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: `# pairdisplay -g <group>` ***Note:*** Italic font is also used to indicate variables.
[ ] square brackets	Indicates optional values. Example: [a | b] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a | b } indicates that you must choose either a or b.
| vertical bar	Indicates that you have a choice between two or more options or arguments. Examples: [a | b] indicates that you can choose a, b, or nothing. { a | b } indicates that you must choose either a or b.
underline	Indicates the default value. Example: [a | b]

This document uses the following icons to draw attention to information:

Icon	Meaning	Description
	Note	Calls attention to important and/or additional information.
	Tip	Provides helpful information, guidelines, or suggestions for performing tasks more effectively.
	Caution	Warns the user of adverse conditions and/or consequences (e.g., disruptive operations).
	WARNING	Warns the user of severe conditions and/or consequences (e.g., destructive operations).

Convention for Storage Capacity Values

Physical storage capacity values (e.g., disk drive capacity) are calculated based on the following values:

Physical capacity unit	Value
1 KB	1,000 (10^3) bytes
1 MB	1,000 KB or $1,000^2$ bytes
1 GB	1,000 MB or $1,000^3$ bytes
1 TB	1,000 GB or $1,000^4$ bytes
1 PB	1,000 TB or $1,000^5$ bytes
1 EB	1,000 PB or $1,000^6$ bytes

Logical storage capacity values (e.g., logical device capacity) are calculated based on the following values:

Logical capacity unit	Value
1 block	512 bytes
1 KB	1,024 (2^{10}) bytes
1 MB	1,024 KB or $1,024^2$ bytes
1 GB	1,024 MB or $1,024^3$ bytes
1 TB	1,024 GB or $1,024^4$ bytes
1 PB	1,024 TB or $1,024^5$ bytes
1 EB	1,024 PB or $1,024^6$ bytes

Accessing Product Documentation

The user documentation for the Hitachi RAID storage systems is available on the Hitachi Data Systems Portal: https://hdssupport.hds.com. Check this site for the most current documentation, including important updates that may have been made after the release of the product.

Getting Help

The Hitachi Data Systems customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to the Hitachi Data Systems Portal for contact information: https://hdssupport.hds.com

Comments

Please send us your comments on this document: doc.comments@hds.com Include the document title, number, and revision, and refer to specific section(s) and paragraph(s) whenever possible.

Thank you! (All comments become the property of Hitachi Data Systems.)

1

Introduction

This chapter provides an overview of the Hitachi RAID storage systems and host attachment:

- ☐ About the Hitachi RAID Storage Systems
- ☐ Device Types
- ☐ Installation and Configuration Roadmap

About the Hitachi RAID Storage Systems

The Hitachi RAID storage systems offer a wide range of storage and data services, including thin provisioning with Hitachi Dynamic Provisioning™ software, application-centric storage management and logical partitioning, and simplified and unified data replication across heterogeneous storage systems. These storage systems are an integral part of the Services Oriented Storage Solutions architecture from Hitachi Data Systems, providing the foundation for matching application requirements to different classes of storage and delivering critical services such as:

- Business continuity services
- Content management services (search, indexing)
- Non-disruptive data migration
- Volume management across heterogeneous storage arrays
- Thin provisioning
- Security services (immutability, logging, auditing, data shredding)
- Data de-duplication
- I/O load balancing
- Data classification
- File management services

The Hitachi RAID storage systems provide heterogeneous connectivity to support multiple concurrent attachment to a variety of host operating systems, including HP-UX and other UNIX platforms as well as Windows, Linux, VMware, and mainframe servers, enabling massive consolidation and storage aggregation across disparate platforms. The storage systems can operate with multi-host applications and host clusters, and are designed to handle very large databases as well as data warehousing and data mining applications that store and retrieve terabytes of data.

The Hitachi RAID storage systems are configured with OPEN-V logical units (LUs) and are compatible with most fibre-channel (FC) host bus adapters (HBAs). Users can perform additional LU configuration activities using the LUN Manager, Virtual LVI/LUN (VLL), and LUN Expansion (LUSE) features provided by the Storage Navigator software, which is the primary user interface for the storage systems.

For further information on storage solutions and the Hitachi RAID storage systems, please contact your Hitachi Data Systems account team.

Device Types

Table 1-1 describes the types of logical devices (volumes) that can be configured on the Hitachi RAID storage systems for operation with the HP-UX operating system. Table 1-2 provides the specifications for devices supported by the Hitachi RAID storage systems. Logical devices are defined to the host as SCSI disk devices, even though the interface is fibre channel.

The sector size for the devices is 512 bytes.

Table 1-1 Logical Devices Supported by the Hitachi RAID Storage Systems

Device Type	Description
OPEN-V Devices	OPEN-V logical units (LUs) are logical devices of variable sizes as defined by the user.
OPEN-x Devices	The OPEN-*x* logical units (LUs) (e.g., OPEN-3, OPEN-9) are disk devices of predefined sizes. The Hitachi RAID storage systems supports OPEN-3, OPEN-8, OPEN-9, OPEN-E, and OPEN-L devices. For more information on these device types, please contact your Hitachi Data Systems account team.
LUSE Devices (OPEN-x*n)	LUSE devices are LUs that are created by combining up to 36 LUs. The LUN Expansion (LUSE) software enables you to configure these devices. LUSE devices are designated as OPEN-x*n, where x is the LU type (e.g., OPEN-V) and n is the number of combined devices. For example, a LUSE device created from 10 OPEN-V LUs is designated as an OPEN-V*10 device. This enables the host to access the data stored on the storage system using fewer LU numbers.
VLL Devices (OPEN-x VLL)	VLL devices are customized LUs that are configured using the Virtual LVI/LUN software. The VLL devices are configured by "slicing" a single LU into several smaller LUs that best fit your application needs to improve host access to frequently used files. VLL devices are designated as OPEN-V-CVS devices, where "CVS" stands for custom volume size.
VLL LUSE Devices (OPEN-x*n VLL)	The VLL LUSE feature allows you to combine Virtual LVI/LUN devices (instead of standard OPEN-V LUs) into LUSE devices. For example, a VLL LUSE device created by using LUSE to combine 10 OPEN-V VLL (OPEN-V-CVS) volumes into a single logical device is designated as an OPEN-V*10-CVS device.
FX Devices (3390-3A/B/C, OPEN-x-FXoto)	The Hitachi Cross-OS File Exchange (FX) feature allows you to share data across mainframe, UNIX, and PC server platforms using special multiplatform volumes. The VLL feature can be applied to FX devices for maximum flexibility in volume size. For more information about FX, see the *Hitachi Cross-OS File Exchange User's Guide* (MK-96RD647), or contact your Hitachi Data Systems account team. FX devices are not SCSI disk devices and must be installed and accessed as raw devices. HP-UX server hosts must use FX to access the FX devices as raw devices (no file system, no mount operation). The 3390-3B devices are write-protected from HP-UX server access. The Hitachi RAID storage systems reject all HP-UX server write operations (including fibre-channel adapters) for 3390-3B devices. The 3390-3A/C and OPEN-*x*-FXoto devices are not write-protected for HP-UX server access. Do not execute any write operations on these devices. Do not create a partition or file system on these devices. This will overwrite data on the FX device and prevent the FX software from accessing the device.

Table 1-2 Device Specifications

Device Type	Category (Note 1)	Product Name (Note 2)	# of Blocks (512 B/blk)	# of Cylinders	# of Heads	# of Sectors per Track	Capacity (MB) (Note 3)
OPEN-3	SCSI disk	OPEN-3	4806720	3338	15	96	2347
OPEN-8	SCSI disk	OPEN-8	14351040	9966	15	96	7007
OPEN-9	SCSI disk	OPEN-9	14423040	10016	15	96	7042
OPEN-E	SCSI disk	OPEN-E	28452960	19759	15	96	13893
OPEN-L	SCSI disk	OPEN-L	71192160	49439	15	96	34761
OPEN-V	SCSI disk	OPEN-V	125827200 max ***Note 4***	***Note 5***	15	128	***Note 6***
OPEN-3*n	SCSI disk	OPEN-3*n	4806720*n	3338*n	15	96	2347*n
OPEN-8*n	SCSI disk	OPEN-8*n	14351040*n	9966*n	15	96	7007*n
OPEN-9*n	SCSI disk	OPEN-9*n	14423040*n	10016*n	15	96	7042*n
OPEN-E*n	SCSI disk	OPEN-E*n	28452960*n	19759*n	15	96	13893*n
OPEN-L*n	SCSI disk	OPEN-L*n	71192160*n	49439*n	15	96	34761*n
OPEN-V*n	SCSI disk	OPEN-L*n	***Note 4***	***Note 5***	15	128	***Note 6***
OPEN-3 VLL	SCSI disk	OPEN-3-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-8 VLL	SCSI disk	OPEN-8-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-9 VLL	SCSI disk	OPEN-9-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-E VLL	SCSI disk	OPEN-E-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-V VLL	SCSI disk	OPEN-V	***Note 4***	***Note 5***	15	128	***Note 6***
OPEN-3*n VLL	SCSI disk	OPEN-3*n-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-8*n VLL	SCSI disk	OPEN-8*n-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-9*n VLL	SCSI disk	OPEN-9*n-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-E*n VLL	SCSI disk	OPEN-E*n-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-V*n VLL	SCSI disk	OPEN-V*n	***Note 4***	***Note 5***	15	128	***Note 6***
3390-3A	FX otm/mto	3390-3A	5820300	3345	15	116	2844
3390-3B	FXmto	3390-3B	5816820	3343	15	116	2844
3390-3C	FXotm	OP-C-3390-3C	5820300	3345	15	116	2844
FX OPEN-3	FXoto	OPEN-3	4806720	3338	15	96	2347
3390-3A VLL	FX otm/mto	3390-3A-CVS	***Note 4***	***Note 5***	15	116	***Note 6***
3390-3B VLL	FXmto	3390-3B-CVS	***Note 4***	***Note 5***	15	116	***Note 6***
3390-3C VLL	FXotm	OP-C-3390-3C-CVS	***Note 4***	***Note 5***	15	116	***Note 6***
FX OPEN-3 VLL	FXoto	OPEN-3-CVS	***Note 4***	***Note 5***	15	96	***Note 6***

Note 1: The category of a device (SCSI disk or FX) determines its volume usage. Table 1-3 shows the volume usage for SCSI disk devices and FX devices. The SCSI disk devices (OPEN-*x*, VLL, LUSE, and VLL LUSE) are usually formatted with file systems for HP-UX operations. The FX devices (3390-3A/B/C, and OPEN-*x*-FXoto) must be installed as raw devices and can only be accessed using the FX software. Do not partition or create a file system on any device used for FX operations.

Table 1-3 Volume Usage for Device Categories

Category	Device Type	Volume Usage
SCSI Disk	OPEN-*x*, OPEN-*x* VLL, OPEN-*x**n LUSE, OPEN-*x**n VLL LUSE	File System or Raw Device (e.g., some applications use raw devices)
FX	3390-3A/B/C 3390-3A/B/C VLL OPEN-*x* for FXoto, OPEN-*x* VLL for FXoto	Raw Device

Note 2: The command device (used for Command Control Interface (CCI) operations) is distinguished by **–CM** on the product name (e.g., OPEN-3-CM, OPEN-3-CVS-CM). The product name for VLL devices is OPEN-*x*-CVS, where CVS = custom volume size.

Note 3: This capacity is the maximum size which can be entered using the **lvcreate** command. The device capacity can sometimes be changed by the BIOS or host bus adapter. Also, different capacities may be due to variations such as 1 MB = 1000^2 or 1024^2 bytes.

Note 4: The number of blocks for a VLL volume is calculated as follows:

# of blocks = (# of data cylinders) × (# of heads) × (# of sectors per track)

The number of sectors per track is 128 for OPEN-V and 96 for the other emulation types.

Example: For an OPEN-3 VLL volume with capacity = 37 MB:

# of blocks = (53 cylinders – see Note 2) × (15 heads) × (96 sectors per track) = 76320

Note 5: The number of data cylinders for a Virtual LVI/LUN volume is calculated as follows (↑**...**↑ means that the value should be rounded up to the next integer):

- Number of data cylinders for OPEN-*x* VLL volume (except for OPEN-V) = **# of cylinders = ↑ (capacity (MB) × 1024/720 ↑**

  Example: For OPEN-3 VLL volume with capacity = 37 MB:

  # of cylinders = ↑37 × 1024/720↑ = ↑52.62↑
  = 53 cylinders

- Number of data cylinders for an OPEN-V VLL volume =
  # of cylinders = ↑ (capacity (MB) specified by user) × 16/15 ↑

  Example: For OPEN-V VLL volume with capacity = 50 MB:

  # of cylinders = ↑50 × 16/15↑ = ↑53.33↑ = 54 cylinders

- Number of data cylinders for a VLL LUSE volume (except for OPEN-V) =
  # of cylinders = ↑ (capacity (MB) × 1024/720 ↑ × n

  Example: For OPEN-3 VLL LUSE volume with capacity = 37 MB and n = 4:

  # of cylinders = ↑37 × 1024/720↑ × 4 = ↑52.62↑ × 4 = 53 × 4 = 212

- Number of data cylinders for an OPEN-V VLL LUSE volume =
  # of cylinders = ↑ (capacity (MB) specified by user) × 16/15 ↑ × n

  Example: For OPEN-V VLL LUSE volume with capacity = 50 MB and n = 4:

  # of cylinders = ↑50 × 16/15↑ × 4 = ↑53.33↑× 4 = 54 × 4 = 216

- Number of data cylinders for a 3390-3A/C =
  # of cylinders = (number of cylinders) + 9

- Number of data cylinders for a 3390-3B VLL volume =
  # of cylinders = (number of cylinders) + 7

S1 = maximum **lvcreate** size value for VLL, LUSE, and VLL LUSE devices. Calculate the maximum size value (in MB) as follows: S1 = (PE Size) × (Free PE). ***Note:*** Do not exceed the maximum **lvcreate** size value of 128 GB.

Note 6: The size of an OPEN-*x* VLL volume is specified by capacity in MB, not number of cylinders. The size of an OPEN-V VLL volume can be specified by capacity in MB or number of cylinders. The user specifies the volume size using the Virtual LVI/LUN software.

Installation and Configuration Roadmap

The steps in Table 1-4 outline the general process you follow to install and configure the Hitachi RAID storage system on an HP-UX operating system.

Table 1-4 Installation and Configuration Tasks

Step	Task
1.	Verify that the system on which you are installing the Hitachi RAID storage system meets the minimum requirements for this release.
2.	Prepare the Hitachi RAID storage system for the installation.
3.	Prepare the fibre-channel HBAs for the installation.
4.	Connect the Hitachi RAID storage system to an HP-UX host.
5.	Verify recognition of the new devices.
6.	Verify device files and the driver.
7.	Partition disk devices, create file systems, and set device parameters.
8.	Create mount directories, mount and verify the file systems, and set and verify auto-mount parameters.

2

Installing the Storage System

This chapter describes how to install the Hitachi RAID storage system on an HP-UX operating system:

- ☐ Requirements
- ☐ Preparing for the Storage System Installation
- ☐ Configuring the Host Fibre-Channel HBA(s)
- ☐ Connecting the Storage System to the HP-UX Host
- ☐ Verifying New Device Recognition

Requirements

Table 2-1 lists and describes the requirements for installing the Hitachi RAID storage system on the HP-UX operating system.

Table 2-1 Requirements

Requirement	Description
Hitachi RAID storage system	The availability of features and devices depends on the level of microcode installed on the Hitachi RAID storage system. Use LUN Manager software to configure the fibre-channel ports.
HP-UX system hardware	Please refer to the Hitachi Data Systems interoperability site for specific support information for the HP-UX server: http://www.hds.com/products/interoperability
HP-UX operating system	Please refer to the Hitachi Data Systems interoperability site for specific support information for the HP-UX operating system: http://www.hds.com/products/interoperability Root log-in (superuser) access to the HP-UX system is required.
Fibre-channel HBAs	The Hitachi RAID storage system supports fibre-channel HBAs equipped as follows: ▪ 8-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors. ▪ 4-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors. ▪ 2-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors. ▪ 1-Gbps fibre-channel interface, including shortwave non-OFC optical interface and multimode optical cables with SC connectors. If a switch or HBA with a 1-Gbps transfer rate is used, configure the device to use a fixed 1-Gbps setting instead of Auto Negotiation. Otherwise, it may prevent a connection from being established. However, the transfer speed of CHF port cannot be set as 1 Gbps when the CHF is 8US/8UFC/16UFC. Therefore 1 Gbps HBA and switch cannot be connected. Do not connect OFC-type fibre-channel interfaces to the storage system. For information about supported fibre-channel HBAs, optical cables, hubs, and fabric switches, contact your Hitachi Data Systems account team. For information about supported HBAs, drivers, hubs, and switches, see the Hitachi Data Systems interoperability site: http://www.hds.com/products/interoperability
Fibre-channel utilities and tools	Refer to the documentation for your fibre-channel HBA for information about installing the utilities and tools for your adapter.
Fibre-channel drivers	Do not install/load the driver(s) yet. When instructed in this guide to install the drives for your fibre-channel HBA, refer to the documentation for your adapter.

Preparing for the Storage System Installation

The following sections describe preinstallation considerations to follow before installing the Hitachi RAID storage system.

Hardware Installation Considerations

The Hitachi Data Systems representative performs the hardware installation by following the precautions and procedures in the Maintenance Manual.

Hardware installation activities include:

- Assembling all hardware and cabling.
- Installing and formatting the logical devices (LDEVs). Be sure to obtain the desired LDEV configuration information from the user, including the desired number of OPEN-x, LUSE, VLL, VLL LUSE, and multiplatform (FX) devices.
- Installing the fibre-channel HBAs and cabling. The total fibre cable length attached to each fibre-channel adapter must not exceed 500 meters (1,640 feet).
  - Do not connect any OFC-type connectors to the Hitachi RAID storage system.
  - Do not connect/disconnect fibre-channel cabling that is being actively used for I/O. This can cause the HP-UX system to hang.
  - Always confirm that the devices on the fibre cable are offline before connecting/disconnecting the fibre cable.
- Configuring the fibre port topology. The fibre topology parameters for each fibre-channel port depend on the type of device to which the port is connected, and the type of port. Determine the topology parameters supported by the device, and set your topology accordingly (see Configuring the Fibre-Channel Ports).

Before starting the installation, check all specifications to ensure proper installation and configuration.

LUN Manager Software Installation

The LUN Manager software on Storage Navigator is used to configure the fibre-channel ports. The user or Hitachi Data Systems representative installs the LUN Manager software. For instructions, see the *Storage Navigator User's Guide*.

Setting the System Option Modes

To provide greater flexibility, the Hitachi RAID storage systems have additional operational parameters called *system option modes* (SOMs) that allow you to tailor the storage system to your unique operating requirements. The SOMs are set on the service processor (SVP) by your Hitachi Data Systems representative.

To set and manage the SOMs

1. Review the SOMs for your operational environment. The SOMs are described in detail in the *User and Reference Guide* for your storage system model:
   - *Hitachi VSP User and Reference Guide*, MK-90RD7042
   - *Hitachi USP V/VM User and Reference Guide*, MK-96RD635
2. Work with your Hitachi Data Systems team to make sure the appropriate SOMs are set on your storage system.
3. Check each new revision of the *User and Reference Guide* to see if there are any SOM changes that may apply to your operational environment. If so, contact your Hitachi Data Systems team.

Setting the Host Modes

The Hitachi RAID storage systems have host modes that the storage administrator must set for all new installations (newly connected ports) to HP-UX hosts. The required host mode for HP-UX is **03**. Do not select a host mode other than **03** for HP-UX.

Use the LUN Manager software on Storage Navigator to set the host mode. For instructions, see the *LUN Manager User's Guide* for the USP V/VM or the *Provisioning Guide for Open Systems* for the VSP.

Caution: Changing host modes on a storage system that is already installed and configured is disruptive and requires the server to be rebooted.

Setting the Host Mode Options

When each new host group is added, the storage administrator must be sure that all host mode options are set for all host groups connected to HP-UX hosts. The host mode options for HP-UX are **2**, **12**, **23**, and **33**. Select host mode option **2**, **12**, **23**, or **33** when the conditions in Table 2-2 are met. Alternatively, common host mode option 13 can be selected (see Table 2-3).

Use the LUN Manager software on Storage Navigator to set the host mode options. For instructions, see the *LUN Manager User's Guide* for the USP V/VM or the *Provisioning Guide for Open Systems* for the VSP.

Caution: Changing host mode options on a storage system that is already installed and configured is disruptive and requires the server to be rebooted.

Table 2-2 Host Mode Options for HP-UX

No.	Host Mode Option	Select if the Following Conditions are Met	Remarks
2	Veritas Database Edition™/ Advanced Cluster	If you are using either: Veritas Database Edition™/Advanced Cluster for Real Application Clusters, **or** Veritas Cluster Server™ 4.0 or later (I/O fencing function).	Mandatory. Do not apply this option to Sun™ Cluster.
12	For deleting Ghost LUN when HP-UX is connected	Apply this when you want to prevent unmounted devices from creating device files in case HP-UX is connected.	Optional
23	REC Command Support	When the user want to shorten the recovery time on the host side if the data transfer has failed	Optional Available for 60-02-2x or later
33	Set/Report Device Identifier enable For a nickname of the device with HP-UX hosts	Apply this when you want to enable commands to assign a nickname of the device with hosts.	Optional Available for 60-04-0x or later (from Storage Navigator)

Table 2-3 Common Host Mode Option

No.	Host Mode Option	Select if the Following Conditions are Met	Remarks
13	SIM report at link failure	When you want SIM notification when the number of link failures detected between ports exceeds the threshold.	Optional

Configuring the Fibre-Channel Ports

Use LUN Manager software to configure the storage system fibre-channel ports with the appropriate fibre parameters. You select the appropriate settings for each fibre-channel port based on the device to which the port is connected. Determine the topology parameters supported by the device, and set your topology accordingly. The Hitachi RAID storage systems support up to 2048 LUs per fibre-channel port.

Table 2-4 explains the port parameter settings. For more information, see the *LUN Manager User's Guide* for the USP V/VM or the *Provisioning Guide for Open Systems* for the VSP.

Table 2-4 Fibre Parameter Settings

Fabric	Connection	Provides
Enable	FC-AL	FL-port (fabric port)
Enable	Point-to-Point	F-port (fabric port)
Disable	FC-AL	NL-port (private arbitrated loop)
Disable	Point-to-Point	Not supported

Notes:

- If you plan to connect different types of servers to the storage system via the same fabric switch, use the zoning function of the fabric switch.
- Contact Hitachi Data Systems for information about port topology configurations supported by HBA/switch combinations. Not all switches support F-port connection.

Port Address Considerations for Fabric Environments

In fabric environments, port addresses are assigned automatically by fabric switch port number and are not controlled by the port settings. In arbitrated loop environments, the port addresses are set by entering an AL-PA (arbitrated-loop physical address, or loop ID).

Table 2-5 shows the available AL-PA values ranging from **01** to **EF**. Fibre-channel protocol uses the AL-PAs to communicate on the fibre-channel link, but the software driver of the platform host adapter translates the AL-PA value assigned to the port to a SCSI TID. See Appendix A for a description of the AL-PA-to-TID translation.

Table 2-5 Available AL-PA Values

EF	CD	B2	98	72	55	3A	25
E8	CC	B1	97	71	54	39	23
E4	CB	AE	90	6E	53	36	1F
E2	CA	AD	8F	6D	52	35	1E
E1	C9	AC	88	6C	51	34	1D
E0	C7	AB	84	6B	4E	33	1B
DC	C6	AA	82	6A	4D	32	18
DA	C5	A9	81	69	4C	31	17
D9	C3	A7	80	67	4B	2E	10
D6	BC	A6	7C	66	4A	2D	0F
D5	BA	A5	7A	65	49	2C	08
D4	B9	A3	79	63	47	2B	04
D3	B6	9F	76	5C	46	2A	02
D2	B5	9E	75	5A	45	29	01
D1	B4	9D	74	59	43	27	
CE	B3	9B	73	56	3C	26	

Loop ID Conflicts

The HP-UX operating system assigns port addresses from lowest (**01**) to highest (**EF**). To avoid loop ID conflict, assign the port addresses from highest to lowest (i.e., starting at **EF**). The AL-PAs should be unique for each device on the loop to avoid conflicts. Do not use more than one port address with the same TID in same loop (e.g., addresses **EF** and **CD** both have TID 0, see Table 2-5).

Verifying Fibre-Channel Adapters

After configuring the fibre-channel ports, use the **ioscan -f** command to verify that the host fibre-channel adapters are installed properly (see Figure 2-1). Please verify that the underlined items are displayed as a result of **ioscan -f** command. If these items are not displayed, the host environment may not be installed properly. In this case, check the host adapter installation (hardware and driver installation) or the host configuration.

```
# ioscan -f
Class     I   H/W Path           Driver     S/W State H/W Type   Description
============================================================================
bc        0                      root       CLAIMED   BUS_NEXUS
bc        1   8                  bc         CLAIMED   BUS_NEXUS  Pseudo Bus Converter
bc        2   8/0                bc         CLAIMED   BUS_NEXUS  Bus Converter
tty       0   8/0.0              mux2       CLAIMED   INTERFACE  MUX
ext_bus   0   8/4                c720       CLAIMED   INTERFACE  GSC add on Fast/Wide SCSI INTERFACE
target    0   8/4.5              tgt        CLAIMED   DEVICE
disk      0   8/4.5.0            sdisk      CLAIMED   DEVICE     SEGATE ST321S1W
target    1   8/4.7              tgt        CLAIMED   DEVICE
ct1       0   8/4.7.0            sct1       CLAIMED   DEVICE     Initiator
fc        0   8/12               fcT1       CLAIMED   INTERFACE  HP Fibre Channel Mass Storage Adapter
lan       1   8/12.5             fcT1_cntl  CLAIMED   INTERFACE  HP Fibre Channel Mass Storage Cntl
fcp       0   8/12.8             fcp        CLAIMED   INTERFACE  FCP Protocol Adapter
ext_bus   2   8/12.8.0.255.0      fcpdev     CLAIMED   INTERFACE  FCP Device Interface
target    7   8/12.8.0.255.0.6   tgt        CLAIMED   DEVICE
target    8   8/12.8.0.255.0.8   tgt        CLAIMED   DEVICE
target    9   8/12.8.0.255.0.9   tgt        CLAIMED   DEVICE
#
```

Figure 2-1 Verifying Host Fibre-Channel Adapter Installation

Verifying System Diagnostics

Before connecting the Hitachi RAID storage system to an HP 9000 N4000 enterprise server system, verify the following parameter in the **/etc/rc.config.d/diagnostic** file:

- DIAGNOSTICS = 0

If DIAGNOSTICS = 1, change the value to 0 and reboot the HP server.

Note: Setting the DIAGNOSTICS parameter to zero (0) disables error logging for FC. If FC problems occur, you might need to re-enable the DIAGNOSTICS parameter.

Configuring the Host Fibre-Channel HBA(s)

Configure the fibre-channel HBA(s) connected to Hitachi RAID storage system. The HBAs have many configuration options. For more information, refer to the documentation for your fibre-channel HBA(s).

Connecting the Storage System to the HP-UX Host

After you prepare the storage system hardware and software and fibre-channel HBA(s), connect the storage system to the HP-UX system.

Table 2-6 summarizes the steps for connecting the Hitachi RAID storage system to the HP-UX system host. Some steps are performed by the Hitachi Data Systems representative, while others are performed by the user.

Table 2-6 Steps for Connecting the Storage System to an HP-UX Host

	Activity	Performed by	Description
1	Verify storage system installation.	Hitachi Data Systems representative	Confirm that the status of the fibre-channel HBA(s) and LDEVs is NORMAL.
2	Shut down the HP-UX system.	User	Power off the HP-UX system before connecting the Hitachi RAID storage system. ▪ Shut down the HP-UX system. ▪ When shutdown is complete, power off the HP-UX display. ▪ Power off all peripheral devices except for the Hitachi RAID storage system. ▪ Power off the host system. You are now ready to connect the Hitachi RAID storage system.
3	Connect the Hitachi RAID storage system to the HP-UX system.	Hitachi Data Systems representative	Install fibre-channel cables between the storage system and the HP-UX system. Follow all precautions and procedures in the Maintenance Manual. Check all specifications to ensure proper installation and configuration.
4	Power on the HP-UX system.	User	Power on the HP-UX system after connecting the Hitachi RAID storage system: ▪ Power on the HP-UX system display. ▪ Power on all peripheral devices. The Hitachi RAID storage system should be on, the fibre-channel ports should be configured, and the driver configuration file and system configuration file should be edited. If the fibre ports are configured or configuration files edited after the HP-UX system is powered on, restart the system to have the new devices recognized. ▪ Confirm the ready status of all peripheral devices, including the storage system. ▪ Power on the HP-UX system.
5	Boot the HP-UX system.	User	Boot the HP-UX system, and prepare to verify new device recognition.

Verifying New Device Recognition

The final step before configuring the new disk devices is to verify that the host system recognizes the new devices. The host system automatically creates a device file for each new device recognized.

Hitachi Data Systems recommends that the devices should be installed and formatted with the fibre ports configured before the host system is powered on. Type the **cfgmgr** command to force the system to check the buses for new devices.

To verify new device recognition:

1. Login to the HP-UX system as **root** as shown in Figure 2-2.
2. Use the **ioscan -f** command to display the device data. Verify that the system recognizes the newly installed devices (see Figure 2-3). If desired, use the -**C disk** command option (**ioscan -fnC disk**) to limit the output to disk devices only.

Notes:

- If UNKNOWN appears as the Class type, the HP-UX system may not be configured properly. Refer to the HP documentation or contact HP technical support.
- If information for unused devices remains in the system, get the system administrator's permission to renew the device information. To renew the device information, delete the **/etc/ioconfig** and **/stand/ioconfig** files (**rm** command), reboot the server, and then issue the **ioinit -c** command. Now issue the **ioscan -f** command to recognize the logical devices again.

3. Make a blank table (see Table 2-7) for recording the device data. The table must have nine columns for the following data: bus number, bus instance number, disk number, H/W path, driver, device type, target ID, LUN, and device file name. You will need three more columns for entering the major and minor numbers later.
4. Enter the device data for each device (disk devices and raw/FX devices) in your table including the device file name. The device file name has the following structure:

   File name = c***X***t***Y***d***Z***, where ***X*** = bus instance #, ***Y*** = target ID, ***Z*** = LUN.

   The "c" stands for controller, the "t" stands for target ID, and the "d" stands for device. The SCSI target IDs are hexadecimal (0 through F) and the LUN is decimal (0 through 7).

5. Verify that the SCSI TIDs correspond to the assigned port address for all connected ports (see Appendix A). If so, the logical devices are recognized properly. If not:
   a. Check the AL-PA for each port using the LUN Manager software. If the same port address is set for multiple ports on the same loop (AL with HUB), all port addresses except one changed to another value, and the relationship between AL-PA and TID does not correspond to the mapping in Appendix A. Set a different address for each port, reboot the server, and then verify new device recognition again.
   b. If unused device information remains, the TID-to-AL-PA mapping will not correspond to the mapping in Appendix A. Renew the device information (see step 2 for instructions) and then verify new device recognition again.

```
The system is ready.

GenericSysName [HP Release B.11.0] (see /etc/issue)
Console Login: root                                    ← Log in as root.
Password:                                              ← Enter password (not displayed).
Please wait...checking for disk quotas
(c)Copyright 1983-1995 Hewlett-Packard Co.,  All Rights Reserved.
  :
#
```

Figure 2-2 Logging In as Root

```
# ioscan -fn
Class      I   H/W Path    Driver         S/W State H/W Type  Description
=============================================================================
bc         0               root           CLAIMED   BUS_NEXUS
bc         1   8           bc             CLAIMED   BUS_NEXUS Bus Converter
fc         0   8/12                fcT1   CLAIMED INTERFACE HP Fibre Channel Mass Storage
fcp        0   8/12.8              fcp    CLAIMED INTERFACE FCP Protocol Adapter
ext_bus    2   8/12.8.0.255.0      fcpdev CLAIMED INTERFACE FCP Device Interface
target     7   8/12.8.0.255.0.6    tgt    CLAIMED DEVICE
disk       3   8/12.8.8.255.0.6.0  sdisk  CLAIMED DEVICE      HITACHI OPEN-9
                         /dev/dsk/c2t6d0   /dev/rdsk/c2t6d0
disk       4   8/12.8.8.255.0.6.1  sdisk  CLAIMED DEVICE      HITACHI OPEN-9
                         /dev/dsk/c2t6d1   /dev/rdsk/c2t6d1
disk       5   8/12.8.8.255.0.8.0  sdisk  CLAIMED DEVICE      HITACHI 3390*3B
                         /dev/dsk/c2t8d0   /dev/rdsk/c2t8d0
:
#
```

This sample screen shows the following new devices recognized:

- HITACHI OPEN-9 device: bus no. = 8/12, bus instance = 2, target ID = 6, LUN = 0, driver = sdisk
- HITACHI OPEN-9 device: bus no. = 8/12, bus instance = 2, target ID = 6, LUN = 1, driver = sdisk
- HITACHI 3390-3B device: bus no. = 8/12, bus instance = 2, target ID = 8, LUN = 0, driver = sdisk

Figure 2-3 Verifying New Device Recognition

Table 2-7 Sample Device Data Table (showing data for devices in Figure 2-3)

Bus No.	Instance (XX)	Disk No.	H/W Path	Driver	Device Type	TID (Y)	LUN (Z)	Device File	Major # for Char. Files	Major # for Block Files	Minor # 0xXX Y Z 00
8/12	02	3	8/12.8.8.255.0.6.0	sdisk	OPEN-9	6	0	c2t6d0			
8/12	02	4	8/12.8.8.255.0.6.1	sdisk	OPEN-9	6	1	c2t6d1			
8/12	02	5	8/12.8.8.255.0.8.0	sdisk	3390-3B	8	0	c2t8d0			

3

Configuring the New Disk Devices

This chapter describes how to configure the new disk devices that you attached to the HP-UX system host in the previous chapter:

- ☐ Verifying Device Files and the Driver
- ☐ Partitioning Disk Devices
- ☐ Creating File Systems
- ☐ Setting Device Parameters
- ☐ Creating Mount Directories
- ☐ Mounting and Verifying File Systems
- ☐ Setting and Verifying Auto-Mount Parameters

For information on failover and SNMP, see Chapter 4.

For information on SCSI TID maps for FC adapters, see Appendix A.

For information on using the HP-UX System Administrator Manager (SAM) to configure the new devices for LVM operations, see Appendix B.

For information on online installation and configuration of new devices, see Appendix C.

Verifying Device Files and the Driver

The device files for all new devices (SCSI disk and raw/FX) should be created automatically during system startup. Each device should have a block-type device file in the **/dev/dsk** directory and a character-type device file in the **/dev/rdsk** directory. The SCSI disk devices must have both device files. Raw/FX devices only require the character-type device file.

Note: Some HP-compatible systems do not create the device files automatically. If the device files were not created automatically, follow the instructions in Creating Device Files to create the device files manually.

To verify that the device files for the new devices were successfully created:

1. Display the block-type device files in the **/dev/dsk** directory using the **ll** command (equivalent to **ls -l**) with the output piped to **more** (see Figure 3-1). Verify that there is one block-type device file for each device.
2. Use your completed device data table (see Creating Device Files and Table 3-1) to verify that the block-type device file name for each device is correct.
3. Display the character-type device files in the **/dev/rdsk** directory using the **ll** command with the output piped to **more** (see Figure 3-2). Verify that there is one character-type device file for each new device.
4. Use your completed device data table (see Creating Device Files and Table 3-1) to verify that the character-type device file name for each device is correct.
5. After verifying the block-type and character-type device files, verify the HP-UX driver for the storage system using the **ioscan -fn** command (see Figure 3-3).

```
# ll /dev/dsk | more                                          ← Check block-type files.
total 0
brw-r-----  1 bin   sys    28 0x000000 Oct  4 11:01 c0t0d0
brw-r-----  1 bin   sys    28 0x006000 Dec  6 15:08 c0t6d0
brw-r-----  1 bin   sys    28 0x006100 Dec  6 15:08 c0t6d1      ← Block-type device file.
     Bus instance # = 0, SCSI target ID = 6, LUN = 1 ↗
```

Figure 3-1 Verifying Block-Type Device Files

```
# ll /dev/rdsk | more     ← Check character-type files.
total 0
crw-r-----  1 bin   sys   177 0x000000 Oct  4 11:01 c0t0d0
crw-r-----  1 bin   sys   177 0x006000 Dec  6 15:08 c0t6d0
crw-r-----  1 bin   sys   177 0x006100 Dec  6 15:08 c0t6d1  ← Character-type device file.
     Bus instance # = 0, SCSI target ID = 6, LUN = 1 ↗
```

Figure 3-2 Verifying Character-Type Device Files

```
# ioscan -fn
Class      I   H/W Path          Driver S/W State H/W Type  Description
=============================================================================
bc         0                       root   CLAIMED   BUS_NEXUS
bc         1   8                   bc     CLAIMED   BUS_NEXUS Bus Converter
fc         0   8/12                fcT1   CLAIMED INTERFACE HP Fibre Channel Mass Storage
fcp        0   8/12.8              fcp    CLAIMED INTERFACE FCP Protocol Adapter
ext_bus    2   8/12.8.0.255.0      fcpdev CLAIMED INTERFACE FCP Device Interface
target     7   8/12.8.0.255.0.6    tgt    CLAIMED DEVICE
disk       3   8/12.8.8.255.0.6.0  sdisk  CLAIMED DEVICE    HITACHI OPEN-9
                       /dev/dsk/c2t6d0   /dev/rdsk/c2t6d0
disk       4   8/12.8.8.255.0.6.1  sdisk  CLAIMED DEVICE    HITACHI OPEN-9
                       /dev/dsk/c2t6d1   /dev/rdsk/c2t6d1
disk       5   8/12.8.8.255.0.8.0  sdisk  CLAIMED DEVICE    HITACHI 3390*3B
                        /dev/dsk/c2t8d0   /dev/rdsk/c2t8d0
:
#
```

Figure 3-3 Verifying the HP-UX Driver

Creating Device Files

If the device files were not created automatically when the HP-UX system was restarted, issue the **insf -e** command in the **/dev** directory (see Figure 3-4) to instruct the HP-UX system to create the device files. After executing this command, repeat the procedure in Verifying New Device Recognition to verify new device recognition and the device files and driver.

```
# cd /dev
# insf -e
insf: Installing special files for mux2 instance 0 address 8/0/0
       :          :         :        :
       :          :         :        :
#
```

Figure 3-4 Issuing a Command to Create the Device Files

If the device files for the new devices cannot be created automatically, use the **mknod** command to create the device files manually:

1. Obtain your Device Data table on which you recorded the data for the new devices (see Table 3-1). You should have the following information for all new devices:

   Bus number
   Bus instance number
   Disk number
   Driver
   Device type
   Target ID
   LUN

2. Build the device file name for each device, and enter the device file names into your table. Example:

   File name = c***X***t***Y***d***Z***, where ***X*** = bus instance #, ***Y*** = target ID, ***Z*** = LUN.

3. Build the minor number for each device, and enter the minor numbers into your table. Example:

   0x**XXYZ**00, where **XX** = bus instance #, **Y** = SCSI target ID, and **Z** = LUN.

4. Display the driver information for the system using the **lsdev** command (see Figure 3-5).

5. Enter the major numbers for the drivers into your table. You should now have all required device and driver information in the table (see Table 3-1).

6. Create the device files for all new devices (SCSI disk and raw/FX devices) using the **mknod** command (see Figure 3-6). Be sure to create the block-type device files in the **/dev/dsk** directory and the character-type device files in the **/dev/rdsk** directory.

   The character-type device file is required for volumes used as raw devices (e.g., 3390-3A). The block-type device file is not required for raw devices.

   If you need to delete a device file, use the **rm -i** command.

```
# lsdev                                          ← Display driver information.
  Character     Block     Driver     Class
      :           :         :          :
     188          31        sdisk      disk
#
```

This sample screen shows the following system information for the "sdisk" device driver:
Major number of driver sdisk for character-type files: **188**
Major number of driver sdisk for block-type files: **31**

Figure 3-5 Displaying Driver Information

Table 3-1 Completed Device Data Table (sample)

Bus No.	Instance (XX)	Disk No.	H/W Path	Driver	Device Type	TID (Y)	LUN (Z)	Device File	Minor # 0xXXYZ00	Major # – Char. Files	Major # – Block Files
8/12	02	3	8/12.8.8.255.0.6.0	sdisk	OPEN-9	6	0	c2t6d0	0x026000	188	31
8/12	02	4	8/12.8.8.255.0.6.1	sdisk	OPEN-9	6	1	c2t6d1	0x026100	188	31
8/12	02	5	8/12.8.8.255.0.8.0	sdisk	3390-3B	8	0	c2t8d0	0x028000	188	31

```
# cd /dev/dsk                                    ← Go to /dev/dsk directory.
# mknod /dev/dsk/c2t6d0 b 31 0x026000            ← Create block-type file.
          ↖File name  ↖ b = block-type, 31 = major #, 0x026000 = minor #
 :
# mknod /dev/dsk/c2t8d0 b 31 0x028000
          ↖ File name  ↖ b = block-type, 31 = major #, 0x028000 = minor #
```

```
# cd /dev/rdsk                                   ← Go to /dev/rdsk directory.
# mknod /dev/rdsk/c2t6d0 c 188 0x026000          ← Create character-type file.
          ↖ File name   ↖ c = character-type, 177 = major #, 0x026000 = minor #
 :
# mknod /dev/rdsk/c2t8d0 c 188 0x028000
          ↖ File name   ↖ c = character-type, 188 = major #, 0x028000 = minor #
```

Figure 3-6 Creating Block-Type and Character-Type Device Files Manually

Partitioning Disk Devices

The HP-UX system uses the Logical Volume Manager (LVM) to manage the disk devices on all peripheral storage devices including the Hitachi RAID storage system. Under LVM disk management, a volume group consisting of multiple disks is formed, and then the volume group is divided into logical partitions and managed as a logical volume. These procedures should be executed for all device files corresponding to the new Hitachi SCSI disk devices.

WARNING: Do not partition the raw/FX devices (e.g., 3390-3A/B/C). These volumes are not managed by LVM and do not need any further configuration after their character-type device files have been created and verified.

To partition the new SCSI disk devices for LVM operation:

- Create a physical volume for each new SCSI disk device (see Creating Physical Volumes).
- Create new volume groups as desired (see Creating Volume Groups). To increase the maximum volume groups (**maxvgs**) setting.
- Create a logical volume for each new SCSI disk device (see Creating Logical Volumes).

This section provides general instructions and basic examples for partitioning the Hitachi SCSI devices for LVM operations using UNIX commands. These instructions do not explicitly cover all LVM configuration issues. For more information about LVM configuration, refer to the appropriate user documentation or contact HP technical support.

Note: If desired, the HP-UX System Administrator Manager (SAM) can be used instead of UNIX commands to configure the SCSI disk devices. See Appendix B for information about using SAM to configure the devices for LVM operations.

Creating Physical Volumes

The first step in partitioning the new devices is to create a physical volume for each new disk device. Once the physical volumes have been created, you will be able to assign these new physical volumes to new or existing volume groups for management by LVM.

Note: Do not create physical volumes for raw/FX devices (e.g., 3390-3A/B/C).

To create the physical volumes for the new disk devices:

1. Use the **pvcreate** command to create the physical volume with the character-type device file as the argument (see Figure 3-7). Specify the **/dev/rdsk** directory for the character file. You can only create one physical volume at a time.

WARNING: Do not use the **-f** (force) option with the **pvcreate** command. This option creates a new physical volume forcibly and overwrites the existing volume.

2. Repeat step 1 for each new disk device on the Hitachi RAID storage system.

```
# pvcreate /dev/rdsk/c2t6d0                                    ← Create physical volume.
                    ↖ Character-type file for disk device.
Physical volume "/dev/rdsk/c2t6d0" has been successfully created.
# pvcreate /dev/rdsk/c2t6d1
Physical volume "/dev/rdsk/c2t6d1" has been successfully created.
:
```

Figure 3-7 Creating Physical Volumes

Creating Volume Groups

After the physical volumes for the disk devices have been created, you can begin creating new volume groups for the new physical volumes as needed. If desired, you can also add any of the new physical volumes on the Hitachi RAID storage system to existing volume groups using the **vgextend** command. The physical volumes, which make up one volume group, can be located in the same disk system or in different disk systems.

Notes:

- Do not assign the raw/FX devices (e.g., OPEN-*x*-FXoto) to volume groups.
- You may need to modify the HP-UX system kernel configuration (**maxvgs** setting) to allow more volume groups to be created (see Appendix C).

To create a volume group:

4. Use the **ls** command to display the existing volume groups (see Figure 3-8).
5. Use the **mkdir** command to create the directory for the new volume group (see Figure 3-9). Choose a name for the new volume group that is different than all other group names. Do not use an existing volume group name.

   If you need to delete a directory, use the **rmdir** command (e.g., **rmdir /dev/vgnn**).
6. Use the **ls** command to verify the new directory (see Figure 3-9).
7. Use the **ll** command to verify the minor numbers for existing group files with the output piped to **grep** to display only the files containing “group” (see Figure 3-10).
8. Choose a minor number for the new group file in sequential order (i.e., when existing volume groups are vg00-vg05 and next group name is vg06, use minor number 06 for the vg06 group file). Do not to duplicate any minor numbers.

   The minor numbers are hexadecimal (e.g., the tenth minor number is 0x0a0000, not 0x100000).
9. Use the **mknod** command to create the group file for the new directory (see Figure 3-11). Specify the correct volume group name, major number, and minor number. The major number for all group files is **64**.

   If you need to delete a group file, use the **rm -r** command to delete the group file and the directory at the same time (e.g., **rm -r /dev/vgnn**), and start again at step 2.
10. Repeat steps 5 and 6 for each new volume group.

11. Use the **vgcreate** command to create the volume group (see Figure 3-12).

    To allocate more than one physical volume to the new volume group, add the other physical volumes separated by a space (e.g., **vgcreate /dev/vg06 /dev/dsk/c0t6d0 /dev/dsk/c0t6d1**).

    For LUSE volumes with more than 17 OPEN-8/9 LDEVs or more than 7043 MB (OPEN 8/9*n-CVS), use the **-s** and **-e** physical extent (PE) parameters of **vgcreate** (see Figure 3-12).

    Table 3-2 lists the PE and maximum PE (MPE) parameters for the LUSE devices on the Hitachi RAID storage system.

    If you need to delete a volume group, use the **vgremove** command (e.g., **vgremove /dev/vgnn**). If the **vgremove** command does not work because the volume group is not active, use the **vgexport** command (e.g., **vgexport /dev/vgnn**).

12. Use the **vgdisplay** command to verify that the volume group was created correctly (see Figure 3-13). The **-v** option displays the detailed volume group information.

```
# ls /dev                                          ← Display existing volume group names.
vg00
 :
vg05
#
```

Figure 3-8 Displaying Existing Volume Group Names

```
# mkdir /dev/vg06                                  ← Make directory for new volume group.
# ls /dev                                          ← Verify directory for new volume group.
vg00
 :
vg06
#
```

Figure 3-9 Creating and Verifying a Directory for the New Volume Group

```
# ll /dev/vg* | grep group                         ← Display existing group files.
crw-rw-rw-    1 root     root     64 0x000000 Nov 7 08:13 group
                                    ↖ Minor number of existing group file = 00
:
#
```

Figure 3-10 Displaying Minor Numbers for Existing Group Files

```
# mknod /dev/vg06/group c 64 0x060000              ← Create new group file.
                ↖        ↖   ↖ Group name = vg06, major number of group file = 64,
                               Minor number of new group file = 06
:
#
```

Figure 3-11 Creating Group File for New Volume Group

```
# vgcreate /dev/vg06 /dev/dsk/c2t6d0                    ← Create new volume group.
                ↖ Vol group name  ↖ Device file name
Volume group "/dev/vg06" has been successfully created.
Volume group configuration for /dev/vg06 has been saved in /etc/1vmconf/vg06.cof.
# vgcreate -s 8 -e 15845 /dev/vg09 /dev/dsk/c2t7d0      ← Example for LUSE with n=18.
           ↖PE Size  ↖ Max Physical Extent Size (MPE)
Volume group "/dev/vg09" has been successfully created.
Volume Group configuration for /dev/vg09 has been saved in /etc/lvmconf/vg09.cof
```

Figure 3-12 Creating New Volume Group

```
# vgdisplay /dev/vg06                                   ← Verify new volume group.
--- Volume groups ---
VG Name                     /dev/vg06
VG Write Access             read/write
VG Status                   available
Max LV                      255
Cur LV                      0
Open LV                     0
Max PV                      16
Cur PV                      1
Act PV                      1
Max PE per PV               1016                        ← Verify MPE for LUSE devices.
VGDA                        2
PE Size (Mbytes)            4                           ← Verify PE for LUSE devices.
Total PE                    586
Alloc PE                    0
Free PE                     586
Total PVG                   0
```

Figure 3-13 Verifying New Volume Group

Table 3-2 PE and MPE Parameters for LUSE Devices

Device Type		Physical Extent Size (PE)	Max Number of Physical Extents (MPE)
OPEN-3/8/9/E OPEN-3*n (n= 2 to 36) OPEN-3-CVS OPEN-3*n-CVS (n = 2 to 36)		default	default
OPEN-8/9*n	n = 2 to 17	default	default
	n = 18	8	15845
OPEN-E*n	n = 2 to 9	default	default
OPEN-L*n	n=2 to 3	default	default
OPEN-8/9/E-CVS, OPEN-V		default	default
OPEN-8/9/E*n-CVS, OPEN-V*n (n = 2 to 36)	70-119731(MB) × N1	8	default
	119732- (MB) × N1	8	N2

N1 = [Virtual LVI/LUN volume capacity (in MB)] × n
N2 = ↑ N1 / PE ↑ (↑↑ means round up to next integer.)

Example: Volume capacity is 6000 MB for OPEN-9*22-CVS volume:
N1 = 6000 × 22 = 132000
N2 = ↑ 132000/8 ↑ = 16500

Creating Logical Volumes

After you create the new volume groups, create the logical volumes for each new disk device on the Hitachi RAID storage system.

Note: Do not create logical volumes for raw/FX devices (e.g., 3390-3A/B/C).

To create the logical volumes:

1. Use the **lvcreate -L** command to create the logical volume, and specify the volume size and volume group for the new logical volume (see Figure 3-14).

   The HP-UX system assigns the logical volume numbers automatically (lvol1, lvol2, lvol3, …). Use the capacity values specified in Table 1-1 for the size parameter (e.g., OPEN-3 = 2344, OPEN-V = 61432 in maximum size). To calculate S1 for VLL, LUSE, and VLL LUSE volumes:

   Use the **vgdisplay** command to display the physical extent size (**PE Size**) and usable number of physical extents (**Free PE**) for the volume (see Figure 3-15). Calculate the maximum size value (in MB) as follows:

   S1 = (PE Size) × (Free PE)

2. Use the **lvdisplay** command to verify that the logical volume was created correctly (see Figure 3-16). If desired, wait until all logical volumes have been created, then use the ***** wildcard character with the **lvdisplay** command to verify all volumes at one time by (e.g., **lvdisplay /dev/vg06/lvol***).

3. Repeat steps 1 and 2 for each logical volume to be created. You can only create one logical volume at a time, but you can verify more than one logical volume at a time.

   If you need to delete a logical volume, use the **lvremove** command (e.g., **lvremove /dev/vgnn/lvolx**).

   If you need to increase the size of an existing logical volume, use the **lvextend** command (e.g., **lvextend -L** size **/dev/vg**nn**/lvol**x).

   If you need to decrease the size of an existing logical volume, use the **lvreduce** command (e.g., **lvreduce -L** size **/dev/vg**nn**/lvol**x).

```
# lvcreate -L 2344 /dev/vg06                    ← Create new logical volume.
                 ↖ Size of volume = 2344 MB (OPEN-3)
Logical volume "/dev/vg06/lvol1" has been successfully created with character device
"/dev/vg06/rlvol1".
Logical volume "/dev/vg06/lvol1" has been successfully extended.
Volume Group configuration for /dev/vg06 has been saved in /etc/1vmconf/vg06.cof.
```

Figure 3-14 Creating a Logical Volume

```
# vgdisplay /dev/vg01

--- Volume groups ---
VG Name                     /dev/vg01
VG Write Access             read/write
VG Status                   available
Max LV                      255
Cur LV                      0
Open LV                     0
Max PV                      16
Cur PV                      1
Act PV                      1
Max PE per PV               1016
VGDA                        2
PE Size (Mbytes)            4          ← Physical extent size.
Total PE                    586
Alloc PE                    0
Free PE                     586        ← Number of physical extents.
Total PVG                   0
```

This example shows the following information for /dev/vg01:

- Physical extent size = 4
- Usable number of physical extents = 586

Therefore, maximum size value = 4 × 586 = 2344

Figure 3-15 Calculating Volume Size for VLL, LUSE, and VLL LUSE Devices

```
# lvdisplay /dev/vg06/lvol1                                  ← Verify new logical volume.
--- Logical volume ---
LV Name                     /dev/vg06/lvol1
VG Name                     /dev/vg06
LV Permission               read/write
LV Status                   available/syncd
Mirror copies               0
Consistency Recovery        MWC
Schedule                    parallel
LV Size (Mbytes)            2344        (7040 for OPEN-9)      ← 2344 = 586 x 4 = OPEN-3
Current LE                  586         (1760 for OPEN-9)      ← LE = logical extent
Allocated PE                586         (1760 for OPEN-9)      ← PE = physical extent
Stripes                     0
Stripe Size (Kbytes)        0
Bad block                   on
Allocation                  strict
```

Figure 3-16 Verifying a Logical Volume

Creating File Systems

After you create logical volumes, you are ready to create the file system for each new logical volume on the Hitachi RAID storage system. The default file system type for HP-UX version 11i is vxfs.

Note: Do not create file systems for the raw/FX devices (e.g., 3390-3A/B/C).

To create the file system on a new logical volume:

1. Use the **newfs** command to create the file system with the logical volume as the argument.

   Figure 3-17 shows an example of creating the file system for an OPEN-3 volume.

   Figure 3-18 shows an example of creating the file system for an OPEN-9 volume.

   Figure 3-19 shows examples of specifying the file system type (vxfs) with the **newfs** command.

2. Repeat step 1 for each new logical volume on the storage system.

```
# newfs /dev/vg06/rlvol1                                    ← Create file system.
newfs: /etc/default/fs is used for determining the file system type
mkfs (vxfs): Warning -272 sector(s) in the last cylinder are not allocated.
mkfs (vxfs): /dev/vg06/rlvol1 - 2400256 sectors in 3847 cylinders of 16 tracks,
2457.9MB in 241 cyl groups (16 c/g, 10.22Mb/g, 1600 i/g)
Super block backups (for fsck -b) at:
    16,  10040,  20064,  30038,  40112,  50136,  60160,  70184,  80208,  90232,
  ...
2396176
#
```

Figure 3-17 Creating a File System (default file system, OPEN-3 shown)

```
# newfs /dev/vg06/rlvol1                                    ← Create file system.
newfs: / etc/default/fs is used for determining the file system type
mkfs (vxfs): ...
 :
7188496, 7198520, 7208544
#
```

Figure 3-18 Creating a File System (default file system, OPEN-9 shown)

```
# newfs -F vxfs /dev/vg06/rlvol1                            ← Specify file system type.
 :
# newfs -F vxfs /dev/vg06/rlvol2
```

Figure 3-19 Specifying File System Type

Setting Device Parameters

When device files are created, the HP-UX system sets the IO time-out parameter to its default value of 20 seconds and the queue depth parameter to its default value of either 2 or 8. You must change these values for all new disk devices on the Hitachi RAID storage system.

Note: Do not change the device parameters for raw/FX devices (e.g., 3390-3A/B/C).

Setting the IO Time-Out Parameter

The IO time-out parameter for the disk devices on the Hitachi RAID storage system must be set to **60 seconds**. To change the IO time-out parameter:

1. Use the **pvdisplay** command to verify the current IO time-out value (see Figure 3-20).
2. Use the **pvchange -t** command to change the IO time-out value to 60 (see Figure 3-21).
3. Use the **pvdisplay** command to verify that the new IO time-out value is 60 seconds (see Figure 3-22).
4. Repeat steps 1 through 3 for each new disk device on the storage system.

```
# pvdisplay /dev/dsk/c0t6d0                          ← Checking current IO time-out value.
--- Physical volumes ---
PV Name               /dev/dsk/c0t6d0
VG Name               /dev/vg06
PV Status             available
Allocatable           yes
VGDA                  2
Cur LV                1
PE Size (Mbytes)      4
Total PE              586          ← This value is 586 for OPEN-3 and 1760 for OPEN-9.
Free PE               0
Allocated PE          586          ← This value is 586 for OPEN-3 and 1760 for OPEN-9.
Stale PE              0
IO Timeout (Seconds)  default                              ← Default IO time-out value.
```

Figure 3-20 Checking Current IO Time-out Value

```
# pvchange -t 60 /dev/dsk/c0t6d0                          ← Change IO time-out value.
Physical volume "/dev/dsk/c0t6d0" has been successfully changed.
Volume Group configuration for /dev/vg06 has been saved in /etc/lvmconf/vg06.cof
```

Figure 3-21 Changing IO Time-out Value

```
# pvdisplay /dev/dsk/c0t6d0                    ← Verify new IO time-out value.
--- Physical volumes ---
PV Name                /dev/dsk/c0t6d0
VG Name                /dev/vg06
PV Status              available
 :
Stale PE               0
IO Timeout (Seconds)   60                       ← New IO time-out value.
```

Figure 3-22 Verifying New IO Time-out Value

Setting the Queue Depth Parameter

The HP-UX system automatically sets the queue depth to a default value of 2 or 8, depending on the installed HP options and drivers. The queue depth for the Hitachi disk devices must be set as specified in Table 3-3.

Using the **scsictl** command, you can view and change the queue depth parameter for each device one volume at a time. However, the queue depth is reset to the default value the next time the system restarts. Therefore, you must create and register a start-up script to set the queue depth for the disk devices each time the system restarts (see Creating and Registering the Queue Depth Start-Up Script).

Note: Do not set the queue depth for the raw/FX devices (e.g., 3390-3A/B/C).

Table 3-3 Queue Depth Requirements

Parameter	Required Value
Queue depth per LU	≤ 8
Queue depth per port	≤ 1024

To set the queue depth parameter for the new Hitachi devices:

1. If you cannot shut down and restart the system at this time, use the **scsictl** command to set the queue depth for each new device (see Figure 3-23). The **scsictl** commands to set queue depth should be registered as HP-UX start-up script for future reboot.

2. Check the **/sbin/init.d** and **/sbin/rc1.d** directories to see whether the script name **queue** is already used (link name **Sxxxqueue** or **Kxxxqueue**) (see Figure 3-24). Choose a unique name for the start-up script as follows:
   a. If there is no script named queue and no link file named **Sxxxqueue** or **Kxxxqueue**, use the name queue for the new script and go to step 3.
   b. If the script queue and the link file **Sxxxqueue** or **Kxxxqueue** exist and the script is used to set the queue depth for other previously installed Hitachi RAID storage systems, check the script file to see whether the queue depth is set to the desired number (per Table 3-3) and add a line for each new disk device. If necessary, restart the HP-UX system to set the queue depth for the new volumes.
   c. If the script queue and the link file **Sxxxqueue** or **Kxxxqueue** already exist and the script is not used for setting the queue depth for the Hitachi RAID storage system, use another name for the new queue-depth script for the storage system (e.g., **hitachi_q**) and go to step 3.

Note: If the link **Sxxxqueue** and/or **Kxxxqueue** exists, but there is no script file named **queue**, delete the link file(s), use the name **queue** for the new script, and go to step 3.

3. Choose a unique 3-digit number for the link name. This number cannot be used in any other links. The link name is derived as follows: **S** stands for "start up script," **K** stands for "kill script," the three-digit number is unique to each link, and the script file name follows the three-digit number (e.g., **S890queue** or **S890hitachi_q**).
4. Create and register the new start-up script for the Hitachi RAID storage system (see Creating and Registering the Queue Depth Start-Up Script for an example).
5. Shut down and restart the HP-UX system, so the new start-up script sets the queue depth for the disk devices to the specified value (per Table 3-3).
6. After restarting the system or setting the queue depths manually, use the **scsictl** command to verify the queue depth for each Hitachi disk device (see Figure 3-25).

```
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t6d0  ←Set queue depth per Table 3-3.
                                                    ↖ Character-type device file
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t6d1
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t6d2
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t6d3
  :
  :
# /usr/sbin/scsictl -m queue_depth=8 -a /dev/rdsk/c0t8d0
```

Figure 3-23 Changing Queue Depth

```
# ls /sbin/init.d                                          ← Check for QUEUE.
OspfMib     clean_ex   dfs        hpether    names      nis.server savecore   swconfig
SnmpHpunix clean_tmps diagnostic iforls     ncs        pd         sendmail   syncer
 :
clean_adm  ddfa       hparray    mrouted    nis.client rwhod      swcluster  xntpd
# ls /sbin/rc1.d                          ← Check for SxxxQUEUE and KxxxQUEUE.
K230audio       K340xntpd   K420dfs         K475rarpd       K630named      S420set_date
K240auditing    K356vjed    K430dce         K480rdpd        K660net        S440savecore
K250envd        K358egcd    K435OspfMib     K490gated       K700nettl      S500swap_start
K258diagnostic  K360kks     K435SnmpHpunix  K500inetd       K770ptydaemon  S520syncer
K270cron        K370vt      K435SnmpMib2    K510mrouted     K780syslogd
K278pd          K380xfs     K440SnmpMaster  K570nfs.client  K900swagentd
K280lp          K390rbootd  K450ddfa        K580nis.client  S100localmount
K290hparray     K400iforls  K460sendmail    K590nis.server  S320hostname
K300acct        K410ncs     K470rwhod       K600nfs.core    S400set_prvgrp
```

Figure 3-24 Checking Existing Script Names and Link Names

```
# /usr/sbin/scsictl -a /dev/rdsk/c0t6d0                    ← Verify new queue depth.
                                  ↖ Character-type device file
immediate_report = 0; queue_depth = 8                      ← Queue depth = 8.
:
:
# /usr/sbin/scsictl -a /dev/rdsk/c0t8d0                    ← Verify new queue depth.
immediate_report = 0; queue_depth = 8                      ← Queue depth = 8.
```

Figure 3-25 Verifying Queue Depth

Creating and Registering the Queue Depth Start-Up Script

The **queue** (or **hitachi_q**) start-up script sets the queue depth to 2 for all new volumes (SCSI disk devices) on the Hitachi RAID storage system each time the HP-UX system restarts. If the **queue** script exists for a previously installed Hitachi RAID storage system, check the script file to verify that the queue depth value is set to the desired value (see Table 3-3), and add a line for each new volume (see Figure 3-26). If the script does not exist, create and register the script as shown in Figure 3-26. You can use the UNIX **vi** editor or other text editor to create or edit the script.

Note: For questions about creating and registering the start-up script, refer to the UNIX and/or HP user documentation, or ask your Hitachi Data Systems representative for assistance.

```
# cp /sbin/init.d/template /sbin/init.d/queue      ← Copy start-up script template file.
# vi /sbin/init.d/queue                              ← Edit script file as shown below.
-------------------------file(/sbin/init.d/queue)----------------------
# !/sbin/sh
#
# @(#) $Revision: 78.1 $
#
# NOTE:    This script is not configurable!  Any changes made to this
#          script will be overwritten when you upgrade to the next
#          release of HP-UX.
#
# WARNING: Changing this script in any way may lead to a system that
#          is unbootable.  Do not modify this script.
#
# <Insert comment about your script here>
#
# Allowed exit values:
#  0 = success; causes "OK" to show up in checklist.
#  1 = failure; causes "FAIL" to show up in checklist.
#  2 = skip; causes "N/A" to show up in the checklist.
#           Use this value if execution of this script is overridden
#     by the use of a control variable, or if this script is not
#     appropriate to execute for some other reason.
#       3 = reboot; causes the system to be rebooted after execution.
# Input and output:
#       stdin is redirected from /dev/null
#       stdout and stderr are redirected to the /etc/rc.log file
#       during checklist mode, or to the console in raw mode.

PATH=/usr/sbin:/usr/bin:/sbin
export PATH

# NOTE: If your script executes in run state 0 or state 1,then /usr
#      might not be available.  Do not attempt to access commands or
#      files in /usr unless your script executes in run state 2 or
#      greater.  Other file systems typically not mounted until run
#      state 2 include /var and /opt.

rval=0

# Check the exit value of a command run by this script.  If non-zero,
# the exit code is echoed to the log file and the return value of this
# script is set to indicate failure.
set_return()  {
       x=$?
       if [ $x -ne 0 ]; then
              echo "EXIT CODE: $x"
              rval=1 # script FAILed
       fi
}
```

Figure 3-26 Example Start-up Script with Changes for Hitachi Devices (continues on the following pages)

```
# Kill the named process(es).
# $1=<search pattern for your process>

killproc()  {
       pid=`ps -el | awk '( )$NF ~ /'"$1"'/) && ($4 !=mypid) && ($5 !=
mypid)  ){ print $4 }' mypid=$$ `
       if [ "X$pid" != "X" ]; then
              if kill "$pid"; then
                     echo "$1 stopped"
              else
                     rval=1
                     echo "Unable to stop $1"
              fi
       fi
}

case $1 in
'start_msg')
        # Emit a _short_ message relating to running this script with
        # the "start" argument; this message appears as part of the
        # checklist.
        echo "Setting the queue value"                          ← Edit text here.
        ;;
'stop_msg')
       # Emit a _short_ message relating to running this script with
       # the "stop" argument; this message appears as part of the
       # checklist.
       echo "Stopping the <specific> system"
       ;;

'start')
_____________________________________________________________
       # source the system configuration variables            |
       if [ -f /etc/rc.config ] ; then                       | ← Delete these lines.
              . /etc/rc.config                               |
       else                                                  |
              echo "ERROR: /etc/rc.config defaults file MISSING"  |
       fi                                                    |
                                                             |
       # Check to see if this script is allowed to run...    |
       if [ "$CONTROL_VARIABLE" != 1 ]; then                 |
              rval=2                                         |
       else                                                  |
                                                             |
       # Execute the commands to stop your system            |
       :                                                     |
       fi                                                    |
_____________________________________________________________|

       /usr/sbin/scsictl -m queue_depth=8 /dev/rdsk/c0t6d0       ← Add one line for each
       /usr/sbin/scsictl -m queue_depth=8 /dev/rdsk/c0t6d1       ←      new disk device.
       /usr/sbin/scsictl -m queue_depth=8 /dev/rdsk/c0t8d0       ←
        :
       ;;
'stop')
```

Figure 3-26 Example Start-Up Script with Changes for Hitachi Devices (continued)

```
      # source the system configuration variables
      if [ -f /etc/rc.config ] ; then
            . /etc/rc.config
      else
            echo "ERROR: /etc/rc.config defaults file MISSING"
      fi

      # Check to see if this script is allowed to run...
      if [ "$CONTROL_VARIABLE" != 1 ]; then
            rval=2
      else
       :
      # Execute the commands to stop your system

      fi
      ;;
*)
      echo "usage: $0 {start|stop|start_msg|stop_msg}"
      rval=1
      ;;
esac
exit $rval
-------------------------end of file(/sbin/init.d/queue)---------------------

# ls /sbin/rc1.d                                          ← Check link names.
K230audio       K340xntpd   K420dfs         K475rarpd       K630named       S420set_date
K240auditing    K356vjed    K430dce         K480rdpd        K660net         S440savecore
K250envd        K358egcd    K435OspfMib     K490gated       K700nettl       S500swap_start
K258diagnostic  K360kks     K435SnmpHpunix  K500inetd       K770ptydaemon   S520syncer
K270cron        K370vt      K435SnmpMib2    K510mrouted     K780syslogd
K278pd          K380xfs     K440SnmpMaster  K570nfs.client  K900swagentd
K280lp          K390rbootd  K450ddfa        K580nis.client  S100localmount
K290hparray     K400iforls  K460sendmail    K590nis.server  S320hostname
K300acct        K410ncs     K470rwhod       K600nfs.core    S400set_prvgrp

# ln -s /sbin/init.d/queue /sbin/rc1.d/S890queue          ← Create link file.
                                  ↖ Be sure this file name does not already exist.
```

Figure 3-26 Example Start-Up Script with Changes for Hitachi Devices (continued)

Creating Mount Directories

After you create the file systems and set the device parameters, create the mount directory for each volume. Choose a unique name for each mount directory that identifies the logical volume.

To create the mount directories:

1. Use the **mkdir** command to create the mount directory with the new mount directory name as the argument (see Figure 3-27).
2. Use the **ls -x** command to verify the new mount directory (see Figure 3-27).
3. Repeat steps 1 and 2 for each new device on the Hitachi RAID storage system.

   If you need to delete a mount directory, use the **rmdir** command.

```
# mkdir /USP-LU00                                          ← Create new mount directory.
# ls –x                                                     ← Verify new mount directory.
USP-LU00    bin     dev       device    etc       export
floppy      home    hstsboof  kadb      kernel    lib
#
```

Figure 3-27 Creating and Verifying a Mount Directory

Mounting and Verifying File Systems

After you create the mount directories, mount the file system for each new logical volume and verify the file systems.

To mount and verify the file systems:

1. Use the **mount** command to mount the file system for the volume (see Figure 3-28).
2. Repeat step 1 for each new logical volume on the Hitachi RAID storage system.
3. Use the **bdf** command to verify that the file systems are correct (see Figure 3-29). Be sure the capacity (listed under **Kbytes**) is correct for each device.
4. Perform basic UNIX operations, such as file creation, copying, and deletion, on each logical device to be sure the new devices on the Hitachi RAID storage system are fully operational (see Figure 3-30).
5. If you want to unmount a file system after it has been mounted and verified, use the **umount** command (e.g., **umount /USP-LU00**).

```
# mount /dev/vg06/lvol1 /USP-LU00                    ← Mount file system.
        ↖ Block-type lvol name  ↖ Mount directory name
#
```

Figure 3-28 Mounting a File System

```
# bdf                                                          ← Verify file systems.
Filesystem          Kbytes    used   avail  %used  Mounted on
/dev/vg00/lvol1      59797   59364       0  100%   /
 :
/dev/vg06/lvol1    2348177       9 2113350    0%   /USP-LU00          ← OPEN-3
/dev/vg07/lvol1    2348177       9 2113350    0%   /USP-LU01          ← OPEN-3
/dev/vg08/lvol1    7052764       9 6347478    0%   /USP-LU02          ← OPEN-9
```

Figure 3-29 Verifying File Systems

```
# mount /dev/vg06/lvol1 /USP-LU00                                    ← Mount LUN.
# cd /USP-LU00                                              ← Go to LUN mount directory.
# cp /bin/vi /USP-LU00/vi.back1                             ← Copy any file to LUN.
# ll                                                         ← Verify file copy.
drwxr-xr-t   2 root     root        8192 Mar 15 11:35  lost+found
-rwxr-xr-x   1 root     sys       217088 Mar 15 11:41  vi.back1
# cp vi.back1 vi.back2                                       ← Copy file again.
# ll                                                         ← Verify second file copy.
drwxr-xr-t   2 root     root        8192 Mar 15 11:35  lost+found
-rwxr-xr-x   1 root     sys       217088 Mar 15 11:41  vi.back1
-rwxr-xr-t   1 root     sys       217088 Mar 15 11:52  vi.back2
# rm vi.back1                                                ← Delete first test file.
# rm vi.back2                                                ← Delete second test file.
```

Figure 3-30 Final Verification of a File System for One Volume

Setting and Verifying Auto-Mount Parameters

The final step in configuring the Hitachi RAID storage system volumes for LVM operations is to set up and verify the auto-mount parameters for each new volume. The **/etc/fstab** file contains the auto-mount parameters for the logical volumes. If you do not plan to auto-mount the new devices, you can skip this section.

To set and verify the auto-mount parameters:

1. Edit the **/etc/fstab** file to add a line for each new volume (SCSI disk device) on the Hitachi RAID storage system (see Figure 3-31). Table 3-4 shows the auto-mount parameters.
2. After you finish editing the **/etc/fstab** file, reboot the HP-UX system. If you cannot reboot at this time, issue the **mount -a** command.
3. Use the **bdf** command to verify the device file systems again (see Figure 3-29).

```
# cp -ip /etc/fstab /etc/fstab.standard                    ← Make backup before editing.
# vi /etc/fstab                                             ← Edit the file (vi shown).
/dev/vg00/lvol1  /           vxfs   rw        0    1   # root
/dev/vg00/lvol2  swap        ignore sw        0    0   # primary swap
 :
/dev/vg06/lvol1  /USP-LU00   vxfs   defaults  0    2   # USP-LU00
/dev/vg06/lvol2  /USP-LU01   vxfs   defaults  0    2   # USP-LU01
      ①           ②          ③      ④       ⑤    ⑥       ⑦          ← See Table 3-4.
```

Figure 3-31 Setting Auto-Mount Parameters

Table 3-4 Auto-Mount Parameters

Parameter #	Name	Enter:
①	Device to mount	Block-type device file name
②	Mount point	Mount directory name
③	File system	Type of file system (e.g., vxfs)
④	Mount options	Usually “defaults”
⑤	Enhance	“0”
⑥	File system check (fsck pass)	Order for performing file system checks
⑦	Comment	Any comment statement

4

Failover and SNMP Operation

The Hitachi RAID storage systems support industry-standard products and functions that provide host and/or application failover, I/O path failover, and logical volume management (LVM). The Hitachi RAID storage systems also support the industry-standard simple network management protocol (SNMP) for remote storage system management from the HP-UX server host. SNMP is used to transport management information between the storage system and the SNMP manager on the host. The SNMP agent sends status information to the host(s) when requested by the host or when a significant event occurs.

This chapter describes how failover and SNMP operations are supported on the Hitachi RAID storage systems:

- ☐ Host Failover
- ☐ Path Failover
- ☐ SNMP Remote System Management

Note: The user is responsible for configuring the failover and SNMP management software on the HP-UX server host. For assistance with failover and/or SNMP configuration on the host, refer to the user documentation, or contact the vendor's technical support.

Host Failover

The Hitachi RAID storage systems support the MC/ServiceGuard application failover feature of the HP-UX operating system. The MC/ServiceGuard software is sold separately. Please contact HP for the latest information on the MC/ServiceGuard product.

After new device configuration is complete, be sure to configure the MC/ServiceGuard software on the host server(s) as needed to recognize the new devices. For assistance with MC/ServiceGuard operations, refer to the user documentation or contact HP technical support.

Path Failover

The Hitachi RAID storage systems support the alternate link path failover function for the HP-UX operating system. After new device configuration is complete, configure alternate links to the new devices as needed using the **vgextend** command. For assistance with alternate link operations, refer to the HP-UX user documentation (UNIX man pages) or contact HP technical support.

The Hitachi RAID storage systems also support the Hitachi Dynamic Link Manager (HDLM) for the HP-UX operating system. For further information, see the *Hitachi Dynamic Link Manager™ for HP-UX® User's Guide* (MK-92DLM112).

SNMP Remote System Management

SNMP is a part of the TCP/IP protocol suite that supports maintenance functions for storage and communication devices. The Hitachi RAID storage systems use SNMP to transfer status and management commands to the SNMP Manager on the HP-UX server host (see Figure 4-1). When the SNMP manager requests status information or when a service information message (SIM) occurs, the SNMP agent on the Hitachi RAID storage system notifies the SNMP manager on the HP-UX server. Notification of error conditions is made in real time, providing the HP-UX server user with the same level of monitoring and support available to the mainframe user. The SIM reporting via SNMP enables the user to monitor the Hitachi RAID storage system from the HP-UX server host.

When a SIM occurs, the SNMP agent initiates trap operations, which alert the SNMP manager of the SIM condition. The SNMP manager receives the SIM traps from the SNMP agent, and can request information from the SNMP agent at any time.

Note: The user is responsible for configuring the SNMP manager on the HP-UX server host. For assistance with SNMP manager configuration on the HP-UX server host, refer to the user documentation, or contact the vendor's technical support.

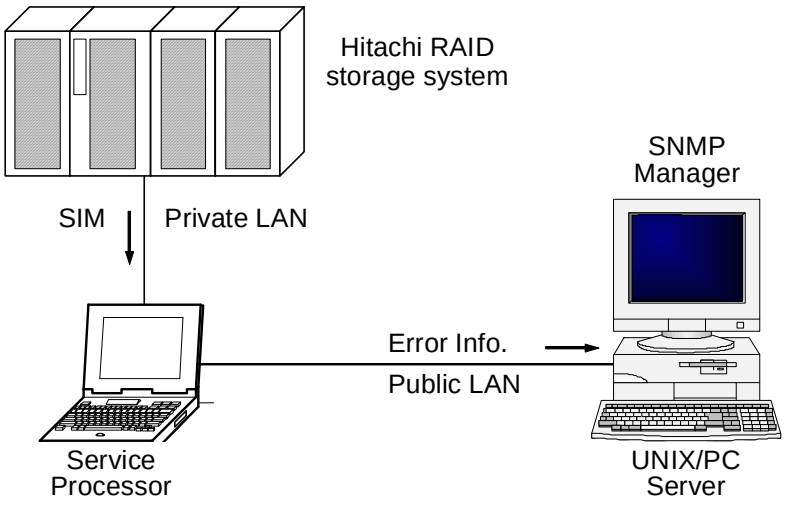


Figure 4-1 SNMP Environment

5

Troubleshooting

This chapter provides troubleshooting information for HP-UX host attachment and includes instructions for calling technical support.

- ☐ General Troubleshooting
- ☐ Calling the Hitachi Data Systems Support Center

General Troubleshooting

Table 5-1 lists potential error conditions that may occur during storage system installation and provides instructions for resolving each condition. If you cannot resolve an error condition, please contact your Hitachi Data Systems representative for help, or call the Hitachi Data Systems Support Center for assistance.

For troubleshooting information on the Hitachi RAID storage system, see the User and Reference Guide for the storage system (e.g., *Hitachi Virtual Storage Platform User and Reference Guide*).

For troubleshooting information on Hitachi Storage Navigator, see the Storage Navigator User's Guide for the storage system (e.g., *Hitachi Virtual Storage Platform Storage Navigator User Guide*).

For information on errors messages displayed by Storage Navigator, see the Storage Navigator Messages document for the storage system (e.g., *Hitachi Virtual Storage Platform Storage Navigator Messages*).

Table 5-1 Troubleshooting

Error Condition	Recommended Action
The logical devices are not recognized by the system.	Ensure the READY indicator lights on the Hitachi RAID storage system are ON. Ensure the fibre-channel cables are correctly installed and firmly connected.
A physical volume cannot be created (PVCREATE command).	Ensure the Hitachi RAID storage system devices are properly formatted. Ensure the character-type device file exists. Ensure the correct character-type device file name is used with **pvcreate**.
A volume group cannot be created (VGCREATE command).	Ensure the directory for the new volume group exists. Ensure the control file exists. Ensure the correct major # (64) and minor # are used with **mknod**. Ensure the block-type file exists and is entered correctly with **vgcreate**. Ensure the physical volume is not already allocated to another volume group.
A logical volume cannot be created (LVCREATE command).	Ensure the specified capacity is not greater than 4096 MB. Ensure the capacity of the volume group is not less than the capacity of the partitioned logical volume.
File system cannot be created (**newfs**).	Ensure the character-type device file is entered correctly with **newfs**.
The file system is not mounted after rebooting.	Ensure the system was restarted properly. Ensure the auto-mount information in the **/etc/fstab** file is correct.
The HP-UX system does not reboot properly after hard shutdown.	If the HP-UX system is powered off without executing the shutdown process, wait **three minutes** before restarting the HP-UX system. This allows the Hitachi RAID storage system internal time-out process to purge all queued commands so that the storage system is available (not busy) during system startup. If the HP-UX system is restarted too soon, the Hitachi RAID storage system will continue trying to process the queued commands and the HP-UX system will not reboot successfully.

Calling the Hitachi Data Systems Support Center

If you need to call the Hitachi Data Systems Support Center, provide as much information about the problem as possible, including:

- The circumstances surrounding the error or failure.
- The exact content of any error messages displayed on the host system(s).
- The exact content of any error messages displayed by Storage Navigator.
- The Storage Navigator configuration information (use the FD Dump Tool).
- The service information messages (SIMs), including reference codes and severity levels, displayed by Storage Navigator.

The Hitachi Data Systems customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to the Hitachi Data Systems Portal for contact information: https://hdssupport.hds.com

A

SCSI ID Maps for Fibre-Channel Adapters

When an arbitrated loop (AL) is established or re-established, the port addresses are assigned automatically to prevent duplicate TIDs. With the SCSI over fibre-channel protocol (FCP), there is no longer a need for target IDs in the traditional sense. SCSI is a bus-oriented protocol requiring each device to have a unique address since all commands go to all devices. For fibre channel, the AL-PA is used instead of the TID to direct packets to the desired destination. Unlike traditional SCSI, once control of the loop is acquired, a point-to-point connection is established from initiator to target. To enable transparent use of FCP, the HP-UX system "maps" a TID to each AL-PA.

The host maps SCSI protocol to fibre-channel protocol and detects and accesses fibre-connected devices using device files (/dev/dsk/c*t*d* and /dev/rdsk/c*t*d*) in the same way as for SCSI-connected devices. The device files for fibre-connected devices are configured in a different way than SCSI-connected devices because fibre supports 126 addresses per path while SCSI supports 16 TIDs per path.

Table A-1 identifies the fixed mappings between the TID values assigned by the HP-UX system and the FC native addresses (AL_PA/SEL_ID) for FC adapters. For each device file (/dev/dsk/c*t*d*), the **c** value is the adapter number, and the **t** value is the target ID. The **c** value depends on the server configuration; a different value is assigned per each column of Table A-1.

Note: The mapping defined in Table A-1 cannot be guaranteed under the following conditions:

- When Hitachi devices and other types of devices are connected in the same loop.
- When information for unused devices remains in server system.
- When multiple ports participate in the same arbitrated loop.

Table A-1 AL-PA to SCSI TID Mapping (t value) for HP-UX Systems

AL-PA	t value	AL-PA	t value	AL-PA	t value	AL-PA	t value	AL-PA	t value
EF	0	CD	0	B2	0	98	0	72	0
E8	1	CC	1	B1	1	97	1	71	1
E4	2	CB	2	AE	2	90	2	6E	2
E2	3	CA	3	AD	3	8F	3	6D	3
E1	4	C9	4	AC	4	88	4	6C	4
E0	5	C7	5	AB	5	84	5	6B	5
DC	6	C6	6	AA	6	82	6	6A	6
DA	7	C5	7	A9	7	81	7	69	7
D9	8	C3	8	A7	8	80	8	67	8
D6	9	BC	9	A6	9	7C	9	66	9
D5	10	BA	10	A5	10	7A	10	65	10
D4	11	B9	11	A3	11	79	11	63	11
D3	12	B6	12	9F	12	76	12	5C	12
D2	13	B5	13	9E	13	75	13	5A	13
D1	14	B4	14	9D	14	74	14	59	14
CE	15	B3	15	9B	15	73	15	56	15

AL-PA	t value	AL-PA	t value	AL-PA	t value
55	0	3A	0	25	0
54	1	39	1	23	1
53	2	36	2	1F	2
52	3	35	3	1E	3
51	4	34	4	1D	4
4E	5	33	5	1B	5
4D	6	32	6	18	6
4C	7	31	7	17	7
4B	8	2E	8	10	8
4A	9	2D	9	0F	9
49	10	2C	10	08	10
47	11	2B	11	04	11
46	12	2A	12	02	12
45	13	29	13	01	13
43	14	27	14	00	–
3C	15	26	15		

B

Reference Information for SAM

This appendix provides reference information about the HP-UX System Administrator Manager (SAM):

- ☐ Overview
- ☐ Using SAM to Configure Devices
- ☐ Using SAM to Set the Maximum Number of Volume Groups

Overview

SAM is a menu-driven utility for performing HP-UX system administration tasks (see Figure B-1). Tasks you can perform using SAM include setting up users and groups, configuring disks and file systems, performing auditing and security activities, and editing the system kernel configuration

SAM has two user interfaces, an X-Windows system interface and a text terminal interface. The primary components and functionality of SAM are the same for both interfaces. The differences are the screen appearance and the navigation methods.

Note: The information in this appendix is provided for reference use only and is not intended to be complete. For more information about using SAM, refer to the online help and/or user documentation for this product or contact HP technical support.

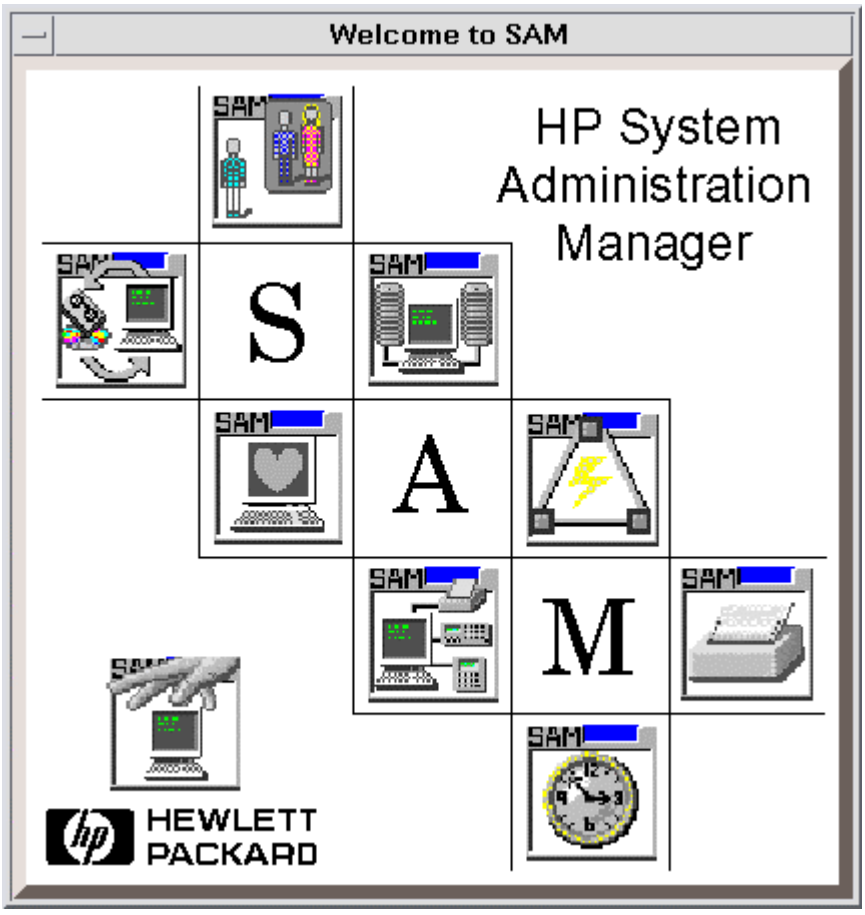


Figure B-1 Welcome to SAM

Using SAM to Configure Devices

The SAM Areas window (see Figure B-2) displays the system administration functions and allows you to select the desired function. The **Disks and File Systems** function (selected in Figure B-2) allows you to configure the new disk devices for LVM operations.

Note: Do not configure the raw/FX devices (e.g., OPEN-*x*-FXoto) for LVM operations.

To configure the new SCSI disk devices using SAM:

1. Select the **Disks and File Systems** function and select **Disk Devices** (see Figure B-3).
2. Verify that the new devices are displayed on the Disk Devices panel.
3. Select the device to configure, select the **Actions** menu, select **Add**, and then select the **Using the Logical Volume Manager** option.
4. On the Add a Disk Using LVM panel, select **Create or Extend a Volume Group…**.
5. On the Create a Volume Group panel, enter the name of the new or existing volume group to assign the new device to, and then select **OK** twice. The Add a Disk Using LVM panel now displays the volume group name.
6. Select **Add New Logical Volume…** to open the Create New Logical Volumes panel.
7. On the Create New Logical Volumes panel, enter the name, size (e.g., 2344 MB for OPEN-3), and mount directory for the new logical volume. Select **Add** and then select **OK** twice.
8. Repeat steps 3 through 7 for each new Hitachi disk device.

Using SAM to Set the Maximum Number of Volume Groups

The HP-UX system kernel specifies the maximum number of volume groups that can be created (default = 10). The **Kernel Configuration** function (next to **Disks and File Systems** in Figure B-2) allows you to change the maximum number of volume groups as needed, for example, to accommodate the new devices on the Hitachi RAID storage system.

To change the maximum number of volume groups using SAM:

1. Select the **Kernel Configuration** function and then select **Configurable Parameters**.
2. On the Configurable Parameters panel, select the **maxvgs** parameter, select the **Actions** menu, and then select **Modify Configurable Parameter...**.
3. On the Modify Configurable Parameter panel, enter the desired maximum number of volume groups in the **Formula/Value** field and then select **OK**.
4. On the Configurable Parameters panel, be sure none of the parameters is selected, select the **Actions** menu, and then select **Create New Kernel**.
5. When the confirmation panel opens, select **Yes** to create the new kernel (or select **No** to return to the Configurable Parameters panel).
6. When the Reboot the System panel opens, select **OK** to move the new kernel into place and reboot the system.

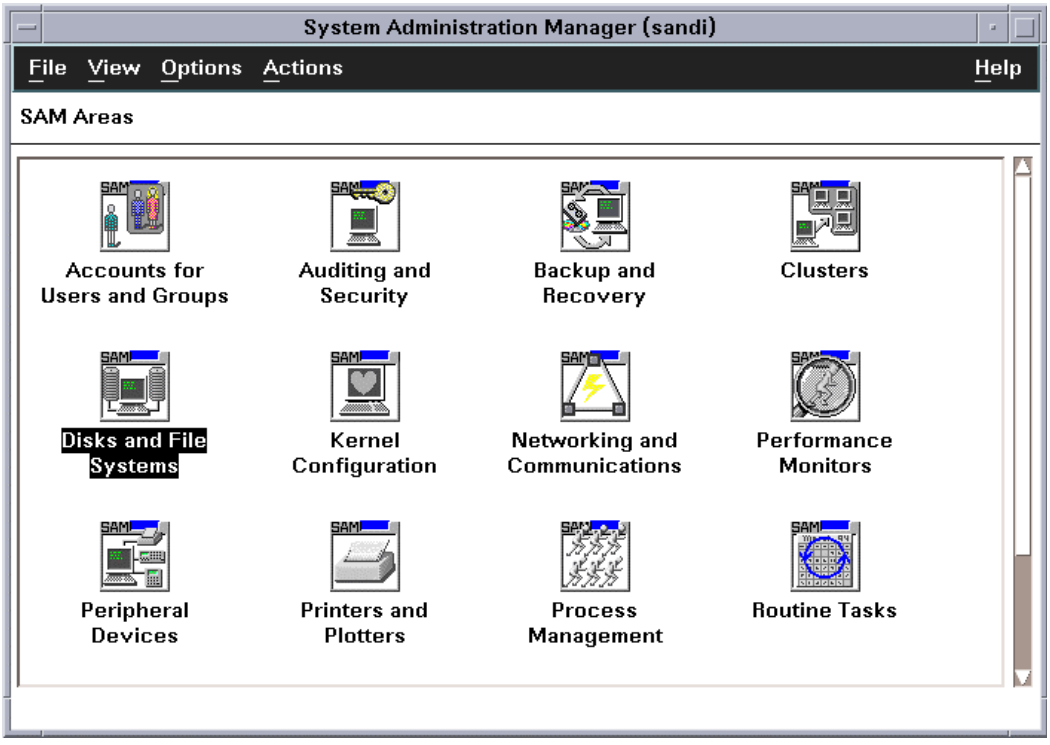


Figure B-2 SAM Areas

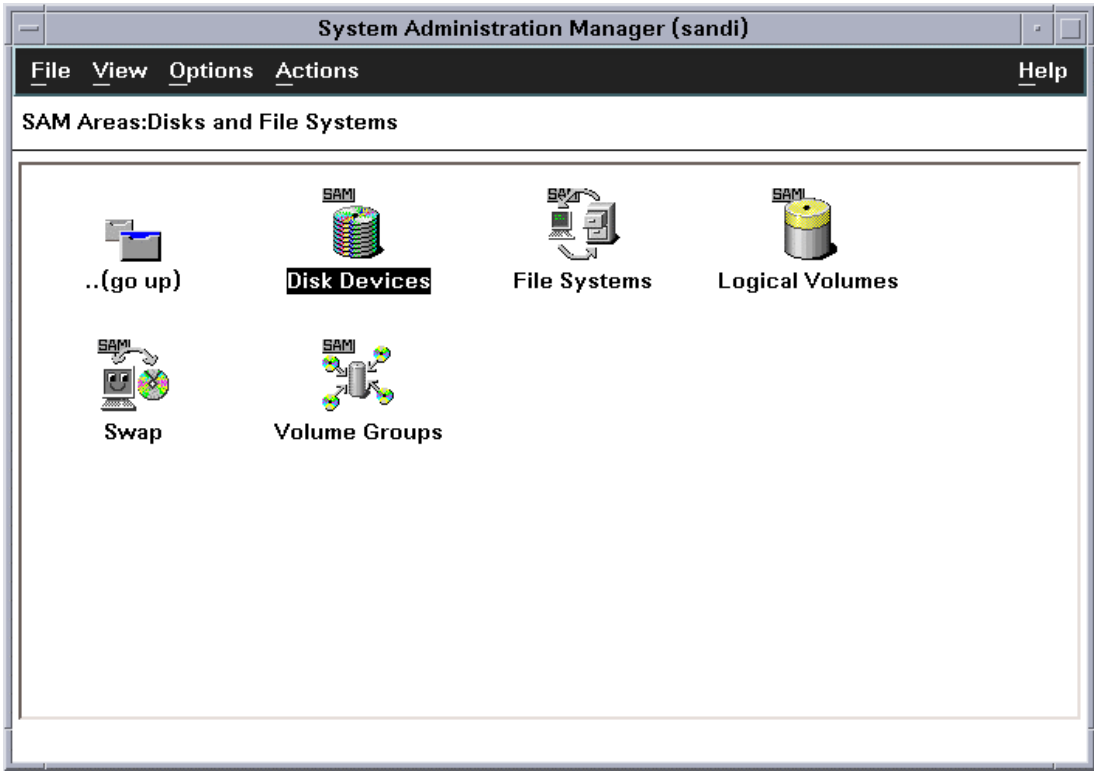


Figure B-3 SAM Areas: Disks and File Systems

C

Online Device Installation

After initial installation and configuration of the Hitachi RAID storage system, additional devices can be installed or de-installed online without having to restart the HP-UX system. This procedure should be performed by the system administrator (i.e., super-user).

Use the normal disruptive device configuration procedure in the following cases:

- **Fibre:** If a new fibre-channel connection is being installed. New fibre-channel connections can only be installed when the host system is powered off. New devices under existing fibre-channel ports can be installed and configured nondisruptively.
- **Maxvgs:** If the **maxvgs** parameter needs to be changed. The procedure for changing the **maxvgs** value in the system kernel requires a system reboot (see Appendix B).

To perform online device installation and configuration:

1. Verify that the new devices on the Hitachi RAID storage system are ready to be configured. The Hitachi Data Systems representative should have completed hardware installation and verified the normal status of the new devices (see Chapter 2 and Chapter 3).
2. Be sure that you are logged in as **root**.
3. Enter the **insf -e** command to perform online device recognition. The **insf -e** command creates device files for the new devices on the existing fibre busses (see Creating Device Files).
4. Configure the new disk devices for HP-UX operations described in Chapter 3. For raw/FX devices, you only need to verify the device files and driver. Do not partition or create a file system on any raw/FX device.
5. Configure the application failover, path failover (i.e., **vgextend**), and/or SNMP software on the HP-UX system as needed to recognize the new disk devices. For additional information on online installation and reinstallation of LUs, see the Maintenance Manual for the storage system.

Note on Using Veritas Cluster Server

By issuing a SCSI-3 Persistent Reserve command for a Hitachi RAID storage system, the Veritas Cluster Server (VCS) provides the I/O fencing function that can prevent data corruption from occurring if the cluster communication stops. Each node of VCS registers reserve keys to the Hitachi RAID storage system, which enables these nodes to share a disk to which the reserve key is registered.

Each node of VCS registers the reserve key when importing a disk groups. One node registers the identical reserve key for all paths of all disks (LU) in the disk group. The reserve key contains a unique value for each disk group and a value to distinguish nodes.

Key format: <Node # + disk group-unique information>

Example: APGR0000, APGR0001, BPGR0000, and so on

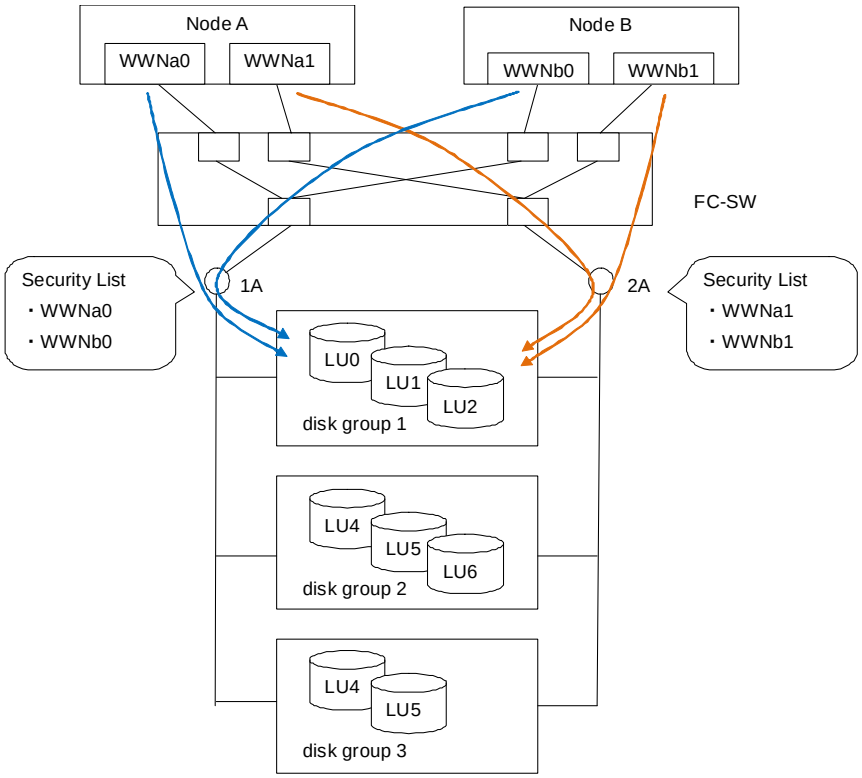
When the Hitachi RAID storage system receives a request to register the reserve key, the reserve key and Port WWN of node are recorded on a key registration table of each port of storage system where the registration request is received. The number of reserve keys that can be registered to one storage system is 128 for a port. The Hitachi RAID storage system confirms duplication of registration by a combination of the node Port WWN and reserve key. Therefore, the number of entries of the registration table does not increase even though any request for registering duplicated reserve keys is accepted.

Calculation formula for the number of used entries of key registration table:
(number of nodes × (number of Port WWN of node) × (number of disk groups)

When the number of registered reserve keys exceeds the upper limit of 128, key registration as well as operations such as installing a LU to the disk group fail. To avoid failure of reserve key registration, the number of reserve keys needs to be kept below 128. For this, restrictions such as imposing a limit on the number of nodes or on the number of server ports using LUN security function or maintaining the number of disk groups appropriate are necessary.

Example:

When adding a LU to increase disk capacity, do not add the number of disk groups, but add a LU to the current disk group.



Key registration table for Port-1A		
Entry	**Reserve Key**	**WWN**
0	APGR0001	WWNa0
1	APGR0002	WWNa0
2	APGR0003	WWNa0
3	BPGR0001	WWNb0
4	BPGR0002	WWNb0
5	BPGR0003	WWNb0
6	-	-
:	:	:
127	-	-

Key registration table for Port-2A		
Entry	**Reserve Key**	**WWN**
0	APGR0001	WWNa1
1	APGR0002	WWNa1
2	APGR0003	WWNa1
3	BPGR0001	WWNb1
4	BPGR0002	WWNb1
5	BPGR0003	WWNb1
6	-	-
:	:	:
127	-	-

Figure D-1 Adding Reserve Keys for LUs to Increase Disk Capacity

Acronyms and Abbreviations

AL	arbitrated loop
AL-PA	arbitrated loop physical address
B	byte
blk	block
CVS	custom volume size
FC	fibre-channel
FCP	fibre-channel protocol
FX	Hitachi Cross-OS File Exchange
GB	gigabyte
Gbps	gigabit per second
HACMP	High Availability Cluster Multi-Processing
HBA	host bus adapter
HDLM	Hitachi Dynamic Link Manager
HP	Hewlett-Packard Company
I/O	input/output
KB	kilobyte
LU	logical unit
LUN	logical unit number
LUSE	LUN Expansion
LVI	logical volume image
LVM	Logical Volume Manager
MB	megabyte
MPE	maximum number of physical extents
OFC	open fibre control
PA	physical address
PB	petabyte
PC	personal computer
PP	physical partition
RAID	redundant array of independent disks

SCSI	small computer system interface
SIM	service information message
SNMP	simple network management protocol
SOM	system option mode
TB	terabyte
TID	target ID
USP V/VM	Hitachi Universal Storage Platform V/VM
VLL	Virtual LVI/LUN
VSP	Hitachi Virtual Storage Platform
WWN	worldwide name

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